

RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

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No. 2

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A MONTHLY PUBLICATION DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

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Introduction of the Carman Lecturer

LEO G. RIGLER, M.D.

IT HAS BEEN customary on former occasions for the President to designate someone to introduce the Carman Lecturer to the members and friends of the Radiological Society of North America, but this is a privilege that I would not relinquish, the privilege of introducing a great scientist and a distinguished physician who is also an old and dear friend, Dr. Owen H. Wangensteen. Our speaker this evening is, I believe, the most creative mind in surgery in America—perhaps in the world. If I were to attempt to relate his accomplishments and his many honors, I might be forced to occupy this podium for the entire evening. Suffice it to say that he has been awarded honorary degrees by St. Olaf's College, the University of Buffalo, and the University of Chicago, as well as many honorary memberships in medical societies, both here and abroad. He has been given the Samuel Gross Medal, the Alvarenza Prize, the John Scott Medal, the American Cancer Society Award, and the Pittsburgh Surgical Society Award. Instead of listing more honors, however, I would prefer to speak of his early beginnings, of his personality, and of the profound effect he has had upon his students and his colleagues.

Dr. Wangensteen is a typical Minnesotan, born in a small town in the northern part of the state, of Norwegian immigrant parents. He grew up in close contact with the earth and its creatures. His first association with medicine came at a very tender age, when he acted as assistant to a veterinary

who attended the cattle in the family dairy. It was the cow's loss and our gain when he realized that his own aspirations were too human and too large to be so restricted.

Dr. Wangensteen and I shared a rather home-grown education at the University of Minnesota, as well as many later experiences. When I returned in 1927 from a year's study abroad, Dr. Wangensteen went to Switzerland to complete the graduate education which he had begun at the University. On his return in 1928, his rise was spectacular and indicative of his quality, for at the age of thirty-two he became Chairman of his Department, the youngest Chief of Surgery in America. His favorite and oft repeated maxim has been: "It is not aptitude but attitude." Fortunately for medical science, he possessed both of these attributes to a superlative degree. His fertile mind, magnificent memory, tenacious resolve, and indefatigable energy have resulted in great accomplishment, crowned in a sense by his recent election as President of the American College of Surgeons. Above all, he has been the great experimenter—impatient of theorizing, intent upon proving. He could well have been the author of the biblical injunction "How long halt ye between opinions."

In our early days I occasionally shared a room with Dr. Wangensteen at meetings, and I recall vividly my astonishment on the first occasion, as I prepared for sleep with a newspaper, to find my roommate sur-



Owen H. Wangenstein, M.D.
Carman Lecturer

rounded by volumes of Shakespeare, Carlyle, Macaulay, and more especially the Bible. Of this last book he is a real student, and I find it especially appropriate to characterize him by a passage from Matthew: "Ask and it shall be given you; seek and ye shall find; knock and it shall be opened to you." He has asked for wisdom; he has sought out new ideas; he has knocked and opened many doors of knowledge to all of us.

When I think of the name Wangensteen, it brings to mind many great contributions to medicine. All of us associate him with studies on intestinal obstruction, ulcer of the stomach and duodenum, cancer of the colon, and other notable achievements which have come from his prolific work. Even more important than these, is the legacy which he will leave to medicine—the magnificent department of surgery which he developed, the many students whom he has taught and fathered, students who are now having a profound influence on the teaching of medicine and on surgical

practice in America. His influence has extended in a remarkable way to his colleagues as well, and in my own case even beyond, because I am sure that it was his inspiration which led both my son and son-in-law to choose the scalpel rather than the x-ray tube.

One of our speaker's absorbing interests for many years has been cancer, and especially cancer of the stomach. Because Russell Carman, whom we honor tonight, was, in his day, a pioneer in the diagnosis of cancer of the stomach and, ironically enough, succumbed to the disease, it seems to me singularly appropriate that we hear this subject discussed on this occasion. I am sure that Russell Carman would greatly approve both the subject and our speaker. It is with a great deal of pleasure, therefore, that I present to you, Dr. Owen Harding Wangensteen, Professor and Chief of the Department of Surgery of the University of Minnesota and President-elect of the American College of Surgeons.



Of Cancer, Gastric Secretion, and of Other Things

The Carman Lecture¹

OWEN H. WANGENSTEEN, M.D.²

A Modern Delilah: When your President, Dr. Leo G. Rigler, our erstwhile Professor of Roentgenology at the University of Minnesota, asked me to give the 1958 Carman Lecture of the American Radiological Society on gastric cancer, I experienced mixed emotions in arriving at a decision. In the first instance, I could not have refused any reasonable request from Leo Rigler, a colleague whom every member of the faculty of the Medical School during his tenure had come to admire, love, and respect. Those of you privileged to know him well know whereof I speak. Radiologist, teacher and friend, of whom one is tempted to speak only in superlatives, he possesses still another unique attribute—that of being able to change the quality of the day for the better for those with whom he associates. Blessed and lucky beyond description is that man who has such a wife or friend.

As a surgeon, coming to you with the results of surgical therapy of a dreadful scourge, I knew it would be exceedingly difficult to bring any new or interesting materials relating to the problem of gastric cancer. It is a gridiron which exhibits obvious evidences of having been heavily trampled in a wet field. Moreover, the distinguished name of Russell D. Carman, identified with your annual lectureship, is deserving of a worthy effort. Under the hypnotic influence of the persuasive eloquence of Leo Rigler, all my misgivings of inadequacy before the subject of gastric cancer vanished. But I know now, my trusted friend of many years is, in a manner, a reincarnated modern hair-trimming Delilah who shears away at one's locks of resistance until all power of independent decision is lost.

Carman—the Man and His Work: On an occasion such as this, when we come together to honor the memory of a great American roentgenologist, it is entirely proper that we commit ourselves for a moment to the piety of memory in an attempt to recapture and appreciate the importance and impact of this man's life upon the field of radiology. It was my privilege, during an exchange year (1924) as Surgical Fellow at the Mayo Foundation in Rochester, to have many casual and informal contacts with Dr. Carman. It was his practice to come each morning to the operating rooms of St. Mary's Hospital. Armed with a list of his studied patients being operated upon, he would wander from room to room to see how his diagnosis tallied with the surgical findings. It was an interesting experience to observe a skilled diagnostician disciplining himself by checking his observations with those at the operating table. And on occasion, when it concerned an especially interesting specimen, he would wander across the hall to the surgical-pathological laboratory, to view a specimen first hand and to check it with his films. My understanding is that Dr. Carman relied heavily on fluoroscopic findings and that in an afternoon he would fluoroscope as many as 30 to 40 patients—a heavy responsibility for anyone. Today, with a larger available complement of radiologists, though the country-wide demands have been by no means met, a more deliberate approach and tempo in this activity probably exists in most places, including the Mayo Clinic.

Dr. Carman was a man of large physique with a kindly benign smile, a friendly grin, and a penetrating glance that took much in without the need of a second look.

¹ Presented at the Forty-fourth Annual Meeting of the Radiological Society of North America, Chicago, Ill., Nov. 16-21, 1958.

² Professor of Surgery, University of Minnesota Hospitals, Minneapolis 14, Minn.

TABLE I: SOME IMPORTANT MILESTONES IN THE RECOGNITION OF GASTRIC CANCER

1824	Demonstration of HCl in gastric juice by Prout (London)
1825	Observations of Beaumont on gastric digestion (U. S. Army)
1836	Discovery of pepsin by Schwann
1842	Demonstration by Bird (London) of absence of free HCl in vomitus of patients with gastric cancer
1869	Introduction of frequent use of gastric aspiration (stomach pump) by Kussmaul (Heidelberg)
1879	Re-emphasis by v. den Velden (Heidelberg) on achlorhydria in patients with gastric cancer
1881	First use of gastroscope by Mikulicz* (Vienna)
1895	Discovery of x-rays by Roentgen (Munich)
1897	X-ray studies of stomachs of cats by Cannon (Boston) employing bismuth subnitrate
1901	X-ray studies of alimentary tract of man by Cannon and Williams (Boston) using opaque x-ray media
1905	Use of bismuth subnitrate as standard opaque meal for x-ray studies in man by Rieder (Munich)
1906	Diagnosis of gastric cancer with use of x-rays by Holzknecht (Vienna)
1908	Introduction of barium sulfate meal, nontoxic contrast medium, by Bachem (Frankfurt) and Günther (Bonn)
1911-1920	Demonstration of great usefulness of fluoroscopy and x-rays in diagnosis of gastric cancer by Holzknecht and Haudek (Vienna), Forssell (Stockholm), Cole (New York), Barclay* (Oxford), Carman* (Rochester, Minn.)
1923	Reintroduction of gastroscopy by Schindler (Los Angeles)

* Died of gastric cancer.

And so it was in his workshop. With a well established routine, quick and definitive decisions were made within a few minutes. His extraordinary capacity to achieve highly accurate diagnoses, relying perhaps more on fluoroscopy than on films, was a source of great surprise to some of his friends in other centers doing the same kind of work.

It is interesting that every paper which Carman wrote had to do with radiology. His first, on the detection of urinary calculi, appeared in 1907, and his last was published posthumously in the year 1926. Carman was born in Iroquois, Ontario, in 1875. He was trained at the Marion-Sims Medical College in St. Louis, Mo., graduating in 1901. He subsequently spent a year in the wards of William Osler at Johns Hopkins. It was there that he decided to become a radiologist, having heard Professor Osler remark in his clinic, in presenting a case of aortic aneurysm, that without the help of radiography the diagnosis could not have been made. Carman, being a man of ready decision, decided, then and there, that he would follow radiology, much to the gain and acceleration of interest in that profession in this country. In 1913, he joined the Staff of the Mayo Clinic as Head of the Section of Radiology.

Carman's contributions to radiology were many, but it is for his important work and description of valuable technics and

devices in the recognition of gastric disorders that he will be primarily remembered. Your Society honors itself in paying homage to the memory of this great pioneer radiologist.

GASTRIC CANCER

Persistence of Therapeutic Apathy Toward Gastric Cancer: When, forty years ago, I was a junior medical student and attended the outpatient clinics of our Medical School at the University of Minnesota, one of my teachers, a well known internist in our area, handed patients, in whom a diagnosis of gastric cancer had been made, a prescription, telling them to come back in six months. I was much puzzled by this therapeutic device and sought to know what the miracle drug was which superseded the knife in the management of gastric cancer. It was decoction of Condurango.

Eighty years ago, our Government sent Dr. W. S. W. Ruschenberger (1), then a Medical Director for the United States Navy, to Ecuador to investigate alleged cures of cancer by the administration of Condurango. In 1873, Ruschenberger's findings were published by the U. S. Printing Office under the title: *A Report on the Origin and Therapeutic Properties of Condurango*. Ruschenberger concluded by saying that there was much testimony but no evidence that Condurango (Cundurango) had any curative influence in cancer.

In 1874, Professor N. Friedrich of Heidelberg (Berlin. klin. Wchnschr. 11: 1, 1874) reported a cure of gastric cancer with this remedy, and for almost fifty years it continued to have a vogue in the management of that disease. There can be no doubt that Friedrich mistook a benign gastric ulcer for a cancer. Let us not in 1958 confuse Condurango, under any other name, with Eldorado!

Four years ago, I had the privilege of participating in a panel discussion on cancer of the stomach at the famed Walter Reed General Hospital in Washington, D. C. I was astounded to encounter there, in one of America's well-known internists, an expression of therapeutic nihilism in the management of gastric cancer, such as I did not appreciate existed today. In fact, such an attitude impresses me as being indefensible in our time.

True, the accomplishment in gastric cancer is modest, but nevertheless real. Every time I review the meager achievements of our clinic in the management of gastric cancer, I am persuaded anew that the promise of the future lies in early detection of visceral cancer. How to achieve that end is a concern we must keep continually in sharp focus until cancer is no longer a matter of general solicitude.

The Silent Interval in Visceral Cancer: In 1947 I reported the silent interval of gastric cancer to be in the area of two years (2). This circumstance subsequently was well documented by Friesen (1950), one of my erstwhile colleagues, now at the University of Kansas (3). Moreover, what is true of gastric cancer probably holds also for a number of other cancers, including cancer of the colon and rectum, and probably of the breast and cervix.

It is on the premise that it is possible to recognize the presence of cancer while it is still asymptomatic that the whole structure of cancer detection rests. Moreover, such studies lend substantial proof to the thesis that, if asymptomatic patients are examined yearly from a group in which the common denominator is increasing years, a fairly large proportion of silent

cancers will be found. The experience of this clinic suggests that this figure is approximately in the area of 3 per cent of all patients examined (women over forty-five and men over fifty). In cervix cancer, routine cytologic examinations of vaginal smears, together with visual examination of the cervix, are paying usurious dividends. In fact, it appears that the mortality from cancer of the cervix is exhibiting a more rapid decline than that of any other cancer. When will we be able to say the same for cancer of the stomach, or of other segments of the alimentary tract, or of the breast? It is early diagnosis that has made this achievement possible in cancer of the cervix.

In this country, approximately 50 per cent of all cancer deaths are attributable to cancer of the alimentary tract. He who can make proctoscopy an entirely painless procedure will make an important contribution to early recognition of rectal cancer and its treatment.³ Development of new methods of cancer detection must come about before consistent recognition of early cancer can be achieved. A few day-dreaming Josephs amongst this or any other group of radiologists could make an important contribution in reducing the large current waste of human life from malignant disease of the alimentary canal, by bringing into being new, reliable, and more precise methods of cancer detection. What impetus and encouragement such devices would lend! And how very much both are needed in the field of visceral cancer today (1).

Classification of Gastric Carcinoma: Though not agreeing completely upon the partition of gastric cancers into the generally accepted categories, pathologists generally recognize the following varieties: polypoid gastric cancer, ulcerating adenocarcinoma, scirrhus cancer, linitis plastica, and superficial spreading carcinoma. Another type, called ulcero-cancer, is often

³ Hypnotic suggestion has proved to be a very useful agent in this clinic in averting fear and apprehension of proctoscopy, thus making the procedure more acceptable to the patient and more satisfying to the examiner.

added by surgeons as well as pathologists, denoting a small group in which the cancer may have originated in the edge of a chronic peptic ulcer. The more likely and frequent situation, no doubt, is that in which an ulcerating adenocarcinoma is mistaken for a benign ulcer. It is in this latter differentiation that ascertainment of whether the stomach secretes free hydrochloric acid can be of great service to both clinician and patient. Certainly, no well oriented medical man, whether internist, radiologist, or surgeon, would approve of a policy of watchful waiting in an achlorhydric patient with a persistent gastric defect.

The Ulcer-Cancer Problem: Much heat and little light have been generated over the question whether gastric ulcers may eventuate in cancer. The considered opinion of pathologists who have studied the problem is that a small but definite percentage of patients who have a chronic gastric ulcer find, with the lapse of time, that they have a gastric cancer. A figure of 5 per cent is accepted by students of the problem as a reasonable appraisal for such transformation. Patients who have undergone gastrojejunostomy for gastric ulcer are known to be gastric cancer prone. Somewhere between 5 and 10 per cent of such patients are likely to show up many years later with a gastric cancer. The years have taught me that my role as a gastric consultant is often merely to ask the patient: "Has your stomach been pumped?" It is amazing to learn how often patients with a persistent gastric defect have had numerous x-ray examinations as well as gastroscopies, and yet have not been urged by their medical attendants—even good internists—to have a gastric analysis to determine whether their stomachs secrete free hydrochloric acid. It is folly to continue advising a patient to pursue conservative management for a chronic gastric defect, if he is achlorhydric. Carman (1921) noted that gastric ulcers in excess of 2.5 cm. in diameter frequently were cancers (4). Cohn (5) of New Orleans (1958), in a thoughtful and provocative analysis, finds that giant gastric ulcers

are frequently cancer, the incidence varying from 28 per cent for ulcers 2.5 cm. in diameter to 37.5 per cent for ulcers 4 cm. in diameter. The two largest gastric ulcerations without tumefaction which have come under my purview—instances in which the greater length of the pancreas was visible from within the stomach—were benign; both patients survive—fourteen and seventeen years after resection. Matthew Stewart (1955) of Leeds, who has been a life-long student of the problem, suggests (6) that 17.7 per cent of all gastric cancers originate in a pre-existing benign gastric ulcer. If carcinoma of the cardia is excluded, Stewart places this figure at 20.1 per cent. This interpretation by one of the world's leading students of the problem is deserving of careful and meditative consideration.

Precursors of Gastric Cancer: Recently, in surgical literature, there has been some debate concerning the potential malignancy of colic and rectal polyps, which are observed not uncommonly on proctoscopic examination in patients over forty years of age. Belief rests essentially on adequacy of proof. Some demand more than others. I count myself among those who believe, on the basis of personal experience and satisfactory documentation, that there is evidence to substantiate the thesis that such lesions may, when neglected, eventuate in cancer. My experience suggests that rectal and colic polyps are probably quicker progenitors or precursors of cancer than are gastric polyps. In other words, the conversion occurs in a shorter period of time. Some of you will recall the very interesting paper of Spriggs and Marxer (1943) on gastric polyps (7), in which they report failure to find in their own cases any suggestion that such lesions were precancerous. The observations of this clinic, however, very definitely indicate that such gastric polyps are precancerous, though the transition from benign to malignant is even slower in the gastric polyp than in the colic polyp, sometimes taking a period of many years. I do not believe that anyone looking over the data reported from this

TABLE II: CURRENT DIAGNOSTIC TRENDS IN GASTRIC CANCER

1. Re-emphasis of value of achlorhydria as a diagnostic screening test in the detection of gastric cancer
2. Greater appreciation of the significance of occult blood in the stool
3. Cytological studies of gastric washings
4. Search for "leak substances" through mucosal defects
5. Appreciation of great length of silent interval in gastric cancer (18-24 months)
6. Emphasis upon value of cancer-detection-center studies
7. Fusion of data of clinician, radiologist, and gastroscopist to insure more reliable diagnoses
8. Abdominal exploration in symptomatic achlorhydric patients with no objective findings

clinic by Hay (1953, 1956) will question the possibility of transition from a benign gastric polyp, with time, into a gastric cancer (8, 9). Hay observed that in gastric polyps 2 cm. or more in diameter, the incidence of malignant change was 50 per cent. In fact, any clinic which employs achlorhydria as a screening test for gastric cancer will of necessity discover a fairly large number of silent gastric polyps if such achlorhydric patients are submitted to routine roentgen examinations. In this clinic alone, over a period of approximately a dozen years, during which time achlorhydric patients have been studied carefully by roentgen as well as gastroscopic technics, 166 cases of gastric polyps have been uncovered.

Apart from the gastric polyp, I must confess I find it difficult to label any other gastric lesions as definitely precancerous. I see no evidence that interstitial gastritis is a precancerous lesion. On the contrary, parietal cell atrophy in the gastric tubule, of which achlorhydria is a forerunner, definitely potentiates the occurrence of gastric cancer. Hitchcock and Sullivan (10) reported from this clinic in 1955 an observed incidence of gastric cancer in achlorhydric patients 5.2 times higher than in the normal population of the same age group (fifty years or more). The manner in which the atrophic parietal cell increases the likelihood to cancer needs exploratory studies.

Intestinalization of the gastric mucosa has been stressed in recent years by a number of observers as the important accompaniment of cancer of the stomach. In fact, Morson (1955) is inclined to believe that replacement of gastric mucosa by the intestinal type may be a precursor of a malignant lesion (11, 12). He also

has observed intestinalization of the gastric mucosa of some gastric polyps.

Diagnosis of Gastric Cancer: In clinical practice it is rare indeed that a patient apprised, upon conclusion of his studies, of the finding of a gastric cancer manifests any surprise. He knew or suspected it all the while. Yet, even in symptomatic patients the diagnosis cannot always be made readily. In fact, in some instances the diagnosis is missed—even in the hands of experts. All this, of course, is a matter of general information among members of your profession, upon whom we rely most heavily for help in the diagnosis. Today all clinicians will agree that roentgen aids constitute the mainstay of diagnosis. Roentgen technics are not yet developed, however, which make it possible to recognize every gastric defect. Some well advanced gastric cancers are not discovered even by expert roentgenologists. Moreover, American roentgenologists appear to have difficulty in detecting the presence of superficial spreading mucosal carcinomas, which has been featured by French roentgenologists, especially René Gutmann (13). We need to know whether this accomplishment is owing primarily to technics which make it possible to identify disturbances of the pattern of gastric motility. When superficial mucosal lesions can be recognized regularly by roentgenologists on this side of the Atlantic, early recognition of gastric cancer will definitely be more frequent. There is no suggestion, however, that the accomplishment of French surgeons with the problem of gastric cancer is better than our own.

Gastroscopy can be very helpful in some cases, as the experience of every clinic on gastroenterology confirms. Nakayama (14) of Japan reports favorably upon use of a

small gastric camera which the patient swallows, in the detection of gastric cancer.

Exfoliative gastric cytology is definitely gaining in popularity in the detection of cancer. In superficial spreading mucosal lesions, as well as in small ulcerating carcinomas, routine use of cytology may help us solve some of our difficult diagnostic problems.

Seven years after Billroth's first successful resection (1881) for gastric cancer, Theodor Storm, the author of *Immensee*, died of the disease (1888). This was seven years before Roentgen's important discovery of the x-rays. The experience of many a patient with gastric cancer today is still unfortunately very much the same as Storm's, who wrote concerning himself in *Beginn des Endes*.⁴

'Tis but a prick, 'tis scarce a pain,
Just felt, to which no name you give:
Henceforth it speaks again—again,
Uneasy now you have to live.
If to complain you try—of what?
You cannot put it into speech:
Within you say, "Indeed 'tis naught!"
Henceforth it holds fast like a leech.
So seldom strange your world does grow,
And quickly are you stript of hope,
Until at last you really know,
That with Death's shaft you cannot cope.

Symptomatic cancers have low curative-resection rates. Seventy years have elapsed since those prophetic telltale heralds of gastric cancer were described by Storm. When will we be able to say "That is history?" Of patients seen at the University of Minnesota Medical Center in the last five years prior to 1954, 10.6 per cent were hopelessly inoperable; of these, one-third were moribund and died of their disease shortly after arriving at the hospital. Since we embarked on an aggressive attack upon the problem of gastric cancer, a larger proportion of late cases seem to find their way to our wards. In an additional 10.3 per cent, exploration alone was carried out. In 6.4 per cent,

it was possible only to do some kind of a bypass operation. Of the gastrectomies, more than a third (36.2 per cent) were palliative. In many series, a large proportion of this number, the operative procedure undoubtedly would have been limited to an exploration. In other words, no operation or a palliative procedure only was done in 53.7 per cent of the 310 cases seen at the University of Minnesota Medical Center during the five-year interval prior to 1954. It is obvious, therefore, that Dr. Rigler is quite correct in suggesting a need for thoughtful reconsideration of the entire subject of gastric cancer by radiologists as well as by surgeons.

Recognition of Silent Gastric Cancer Would Dispel Gloom and Apathy: In 1897, when the late W. W. Keen, great Philadelphia surgeon, was President of the American Medical Association, he said the year 1947, a forward step of fifty years, would see the conquest of the problem of cancer. That prophecy proves to have been an over-optimistic pious hope which badly missed the target. If, to use a Churchillian phrase, we are at the end of the beginning of any phase of the cancer problem, it would be nice to believe that an early break-through will occur in the area of early diagnosis. The five-year survival rate in lymph-node negative resections in this clinic over the eighteen-year period of this study has been 42.3 per cent. For the year 1953, this figure was 77.8.

In this and other clinics, studies are going forward in the search of methods by which silent alimentary tract cancers can be recognized. Nakayama (14) reports help from radioactive phosphorus (P^{32}) in the detection of esophageal and gastric cancers. That cancer has an affinity for P^{32} is readily demonstrated. In our experience, P^{32} radioautographs are of value to the pathologist in instructing him where to cut his sections to find a small or occult cancer.

My associates, Drs. Earl G. Yonehiro, John F. Perry, and others (16), using radio-

⁴ Reproduced by the courtesy of the J.A.M.A. from the author's paper on The Problem of Gastric Cancer, 1947. Translation by Elizabeth Nissen, Associate Professor of Romance Languages, University of Minnesota.

TABLE III: SOME MILESTONES IN MANAGEMENT OF GASTRIC CANCER

1809	Exploration of possibility of gastric resection in dogs and rabbits by Merrem (Philadelphia)
1876	Successful gastric resection in dogs by Gussenbauer and Winiwarer (Vienna)
1879	Unsuccessful gastric resection in man for gastric cancer by Péan (9-4-79, Paris)
1880	Unsuccessful gastric resection in man for gastric cancer by Rydygier (11-16-80, Chelmino, Poland)
1881	First successful partial gastric resection for gastric cancer by Billroth (1-29-81, Vienna)
1897	First successful total gastrectomy for cancer by Schlatter (Zurich)
1905-1930	Demonstration by surgeons that gastric resection could be done with some prospect of cure and at reasonable mortality rates. Finsterer (Vienna), Kirschner* (Heidelberg), W. J. Mayo,* (Rochester, Minnesota), Mikulicz* (Breslau), Moynihan (Leeds), Wilkie* (Edinburgh), and many others
1930 to date	Improvement in pre- and postoperative care. (Fluids, electrolytes, and nutrition; suction to combat distention; hemostasis; blood banks, more liberal use of blood transfusion; improved anesthesia; elimination of hurry in operations; recovery wards; antibiotics; improved nursing care; and many other items)
1945 to date	Lesser operative mortality because of better training and enlarged understanding of surgeons
Current trends in therapy	1. Extended operation including routine removal of spleen and entire potential lymphatic drainage area. Aggressive primary surgery including sacrifice of adjacent organs to which cancer is fixed and more frequent recourse to total gastrectomy 2. Exploration of second-look principle. Repeated reoperation upon lymph-node-positive cases at intervals of six months, until one second look is negative for residual cancer. Study of site of residuals at second-look operations has emphasized the great importance of a thorough primary lymph-node dissection of the portal triad and the retroduodenal choledochal areas

* Died of gastric cancer.

active iron (Fe^{59}), have observed, when allowance is made for the escape of the unbound fraction of the iron by permitting a three-week period to go by before the assessment is begun on stool collections, that demonstration of "leaked" blood from an artificial or erosive source with use of the Geiger counter is approximately twenty-five times as sensitive as is detection of occult blood in the stool by use of the guaiac test.

If surgeons could only get to the other side of the woodpile where the green cases of gastric cancer are accumulating, the effects of our labors would be more in evidence. Today we must still content ourselves largely in working on the dry and rotting wood of the advanced cases of gastric cancer.

Surgery for Gastric Cancer: The most radical operation consistent with a low operative mortality is the best surgical procedure for gastric cancer. Complete excision of the entire lesion, leaving a wide margin of cancer-free resection lines, together with complete excision of the entire lymphatic drainage area of the stomach—these are the important desiderata in the extended operation for gastric cancer. For large lesions of the lesser curvature, it is extremely difficult to be certain that complete excision of the cancer can be effected by any method short of total

gastrectomy. The experience of all surgeons lends testimony to the circumstance that, even in experienced hands, total gastrectomy cannot be done at the same risk as partial gastrectomy. Almost ten years ago (1949) this writer described a technic of performing total gastrectomy by anastomosing the esophagus to the jejunum, employing a posterior buttress. By suturing the mesenteric edge of the jejunum behind the esophagus, and the short peritoneal flap from the diaphragm over the anterior portion of the anastomosis, a nice peritoneal covering for the entire anastomosis could be obtained, thereby lessening the risk of leakage. It was possible to report at that time 28 consecutive total gastrectomies, performed by 8 surgeons in our clinic by this technic, with a single death (3.5 per cent mortality).

One of the shortcomings of this method was that, despite inclusion of an entero-anastomosis beneath the esophagojejunal anastomosis, there occurred a reflux of bile and pancreatic juice into the lower reaches of the esophagus, initiating esophagitis in a number of instances. Shortly thereafter, the Roux-Y operation was substituted to thwart the development of esophagitis. Without question, that advantage of the Roux-Y procedure is real. Yet I am inclined to believe that if the surgeon will make a generous entero-

anastomosis, allowing a distance of 20 cm. to intervene between the esophagojejunal and entero-anastomosis, the likelihood of esophagitis should not be great. My associates and I are fully persuaded from our own experience that the end-to-side esophagojejunal anastomosis employing the posterior buttress can be made at a risk definitely lower than the Roux-Y operation.

Lessons Learned from the Second-Look Procedure: The studies of my associate, Dr. Stuart W. Arhelger, have shown very nicely that the radical operation for gastric cancer prior to 1951 was incomplete on the score that it failed to remove the lymph nodes of the hepatic pedicle and retroduodenal area. As his studies serve to indicate, involvement of this group of lymph nodes is found in approximately 40 to 50 per cent of antral cancers.

The second-look principle for patients who are lymph-node positive has been under scrutiny in this clinic since 1948. Thirty-five patients subjected to 54 second-look operations for gastric cancer have been found to harbor residual cancer. In this group of 35 patients, 3 have been rendered cancer-free by reoperation. One of these patients is alive now, more than eight years after the initial surgery, another more than four years, and the third thirty months—a conversion rate of 8.5 per cent. Yet, at the present moment, only one of these patients has gone more than five years since the last look.

Our best results in second-look procedures have been in the colon. By this means, 4 of 37 patients, all of whom were lymph-node positive at the time of the first colectomy and were found to have residual cancer on the occasion of the first reoperation, have been converted to a cancer-free status—a conversion rate of 10.8 per cent. All of these patients have gone more than five years since the last negative look. In fact, 3 had their negative look approximately eight years ago and 1 more than six years ago.

Our poorest results have been in the rectum, where, to date, we have converted

only 1 of 23 patients. A study of the sites of residual cancer encountered at second-look operations has taught us that the primary operation for cancer of the rectum in patients who have involved lymph nodes is probably an incomplete procedure, despite the aggressiveness of the abdominoperineal surgery. This consideration has led us to extend and enlarge the primary operation, when lymph-node involvement is encountered, so as to include diversion and excision of the pelvic synchondrosis, spreading the pubic girdle with a Tuffier rib spreader. On completion of the procedure, a Parham band is introduced through both obturator foramina to insure stability of the pelvis.

Another area in which the second-look procedure appears to have real promise is in the management of retroperitoneal sarcomas of the fibrolipomyxomatous variety. We have now converted 3 of 8 patients with such tumors, 1 of whom has gone more than five years. Prior to employment of the second-look principle, we had never succeeded in curing any tumor of this variety in the retroperitoneal area.⁵

Results of Surgery: Between Jan. 1, 1936, and Jan. 1, 1954, 157 patients with gastric cancer have survived resection five years or longer in this clinic. This represents an additional gain of 48 five-year survivors during the four-year period covered in this study. All of the five-year survivors were in the curative resection group. The tumors included 150 carcinomas, 1 leiomyosarcoma, and 6 lymphosarcomas (19).

One thing is clear from our most recent experience: If vigorous palliative surgery is extended to the farthest possible limits, the operative mortality begins to compete with the likely gains. In the individual case, it is, of course, a great temptation for the surgeon to try to afford as much palliation as possible. The record sug-

⁵ My colleagues, Drs. Donald Shanon and John Lundseth, have kindly provided me with an analysis of our entire hospital experience with gastric cancer over an eighteen-year interval (19).

gests definitely that such efforts are accompanied by great risks.

One interesting observation in the experience of the last four years is that five-year survivals in the lymph-node-positive group have almost doubled, a reflection, my associates and I believe, of a more complete operation. For the years 1936-1939, as indicated in an earlier report, this figure for the five-year survivors in the lymph-node positive cases was 10.2 per cent. For the last four-year period, upon which the present report is based (1950-1953), the five-year survival rate in this group of patients was 18.5 per cent; among resection survivors, this figure was 22.4 per cent.

There has been a contraction in the five-year survivals in the lymph-node-negative group, the cause of which is not entirely clear at this time. Pursuit of this inquiry suggests that the large increase in number of surgeons doing these operations is in part responsible. Over a period of several years, the surgery of gastric cancer was concentrated largely on one surgical service. More recently, a policy was adopted of assigning these cases to all the surgical services of the department. In fact, the operations over the 1950-1953 period covered in this study were done by 34 surgeons, of whom the greater number were surgical residents. Another and perhaps equally important reason for the increased operative mortality has been a desire within the staff to explore the possibilities of radical surgery, including multiple organ excision in the presence of locally invasive tumors and partial hepatectomy or lobectomy in the presence of hepatic metastases. Palliative total gastrectomy too has been extended far beyond conventional limits—the lessons of this study suggest too far. A return to the end-to-side esophagojejunostomy with an adequate entero-anastomosis or some variant thereof will contribute to a lowering of the operative mortality and consequently to a little better prospect of cure for the lymph-node-negative cases.

Of the 157 five-year survivors reported

herein, 75 per cent had lesions more than 4 cm. in diameter. There are a number of papers in the literature attesting the greater likelihood of cure in lesions less than 2 cm. in diameter.

The overall five-year survival for all patients who reported for observation with the diagnosis of gastric cancer during the period of this report is 14.7 per cent—a definite increase over the earlier periods, despite the rise in operative mortality.

In the period from 1946 to 1949, the overall resection mortality in this clinic, including subtotal and total gastric resections, was 8.8 per cent. For the present period under study (1950-1953), it was 12.8 per cent, made so essentially for the reasons mentioned above. In the lymph-node-negative subtotal resections, the hospital mortality was only 2.2 per cent—1 death in 46 cases. The five-year survival among the lymph-node-negative group surviving resection was 51.7 per cent; for the lymph-node-positive group, this figure was 22.4 per cent. For the year 1953, the five-year survival rate among the lymph-node-negative cases was 77.8 per cent; for the lymph-node positive cases 31.3 per cent. Early diagnosis and a lesser operative mortality are the agencies to which we must look for improvement in our present accomplishment.

Cancer Surgery of the Future: Will developments of our knowledge of cancer or development of chemotherapeutic agents make surgery of cancer unnecessary? That is a good question. As far as the foreseeable future is concerned, I think it safe to say that surgeons will continue to play an important role in the management of visceral and other cancers. Will the services of the surgeon be supplanted by chemotherapeutic measures in the management of advanced cancer? Possibly so. The development and use of special perfusion technics permit employment of doses of cancerocidal drugs which would otherwise prove toxic and lethal. Already, there have been demonstrations of the success of these methods for some malignant growths in the hands of Creech (21) and

TABLE IV: FAIRWAYS OF THE FUTURE IN GASTRIC CANCER

I. Foreseeable Future (5-10 years)
A. Improved results through:
1. Earlier diagnosis
2. Safer surgery
(a) Improved technics of anesthesia
(b) Better postoperative management
(c) Ablation of staphylococcal sepsis
B. Advanced Cancer
1. More effective palliation achieved through:
(a) Development of more effective chemotherapeutic agents
(b) Development of special perfusion technics effective for liver and other organs
II. In the More Remote Future (1 to 5 decades or more)
A. Conquest of cancer by:
1. Knowledge of causes of cancer
2. Cancer prevention
3. Thwarting cancer by chemical and immunologic agents

others. The development of a technic of perfusing the liver could contribute much to the palliation of visceral cancer which has metastasized to the liver. Encouraging improvement has been noted in this clinic by my associate, Dr. Joseph B. Aust, in the perfusion of a few recurrent cancers in the pelvis. Cessation of pain has been dramatic. It remains to be seen how lasting such palliation will be. Agencies which will prolong the benefits of such procedures need to be sought. Life, after all, is merely a postponement of death.

The development of differential organ perfusion, including the lung, liver, and brain, will do a great deal to bring palliation by relatively simple technics to patients with cancers which have extended beyond conventional borders. This does not appear to be an idle dream, even for those with liver involvement.

Understanding the Cancer Enigma: We seem still to be a long way from understanding the cancer problem. It would appear that it may yet require several decades of continuing dedicated effort by trained scientists to solve this enigma so effectively that we come to understand the causes of cancer, a prelude to its prevention. It is not impossible, of course, that within the intervening years, as in smallpox, we may learn how to immunize

against the development of cancer even though we do not know what it is or how it comes about.

SOME FUNCTIONAL STUDIES ON GASTRIC SECRETION

Dissociation of Secretion of Hydrochloric Acid and Pepsin: It is conventionally believed that the secretion of hydrochloric acid and of pepsin go hand in hand; that, when one function fails, so does the other, even though these secretions come from different cells in the gastric tubule. We need to explore this thesis more thoroughly. Certain it is that in such a condition as the achylia gastrica of pernicious anemia both functions are lost. That the achlorhydric stomach of the patient with gastric cancer is not regularly apeptic is revealed in the demonstration of a potential dynamic peptic action in the overnight gastric aspirations of many such patients. In fact, in studies on a small group of 20 histamine-achlorhydric patients in whom the peptic quality of the gastric juice was assessed, it was found that, when the juice was acidulated to the optimal pH for peptic activity (1.6), perfusion of the overnight aspirate produced evidences of severe esophagitis or perforation in 20 per cent of cats perfused in this manner (22).

In our clinic, for almost twenty years, we have used the squamous epithelium of the esophagus, which was found to be surprisingly sensitive to injury by the digestive juices, to test the peptic activity of gastric juices. During the past fifteen years, perfusion of the intact cat's esophagus over a two-hour interval, with an outflow pressure of 20 cm. of gastric juice at 37.5° C., has been used for the assessment of the potential digestive power of the juice. The overnight gastric aspirations of patients with duodenal ulcer quite regularly cause perforation of the cat's esophagus over a two-hour drip period. This technic has been used in this clinic to substantiate the diagnosis of duodenal ulcer in patients who have had none of the classical clinical signs of ulcer and in whom x-ray signs of

duodenal ulcer failed of demonstration. In fact, on the basis of this evidence, 10 patients have been submitted to operation and, in all, characteristic findings of duodenal ulcer were encountered.

The observation of dissociation of secretion of hydrochloric acid and pepsin suggests that functional studies of gastric secretory capacity need to be extended to all recognized categories of gastric cancer. Pathologists and other students of the gastric cancer problem need to address themselves more seriously to the problem of trying to ascertain from what cells in the gastric tubule cancers may arise. Could such studies shed any light on prognosis? Have they any value in determining sites of origin? Only continued observation and study will tell. In any case, it is quite clear that the achlorhydria of gastric cancer is not synonymous with the achylia gastrica encountered quite regularly in the stomachs of patients with pernicious anemia.

The Peptic Quality of the Gastric Juice: The history of gastric digestion is a fascinating chapter of medicine (23). All the intricate details of the skein and fabric of this story have not yet been unraveled. In 1824, Prout reported the presence of hydrochloric acid in the gastric juice. In 1825, William Beaumont, an obscure army surgeon of the United States whose original and important observations and experiments were to make his name famous in the history of gastric digestion, published a brief note on the case of Alexis St. Martin and his gastric fistula. These observations were extended and enlarged in a unique monograph published by Beaumont in 1833.

Beaumont cooled and rewarmed gastric juice but failed to observe that hydrochloric acid *per se* had little capacity to digest or dissolve food. Quantitative chemistry at that time had not advanced to the stage at which the acidity of the gastric juice could be accurately measured. It remained for Schwann (1836), who boiled gastric juice, to observe that its digestive

function was thereby lost. He correctly inferred the presence of an enzyme which potentiated the digestive power of hydrochloric acid. This catalyst Schwann called pepsin.

That hydrochloric acid *per se* possesses little or no digestive action for food or tissue is not generally known or accepted. In fact, one of the keenest modern-day students of the ulcer problem proposed less than two decades ago that the word peptic be deleted and that ulcers be called "acid ulcers." More recent observations have indicated full well the importance of retaining the designation peptic in characterizing ulcers which develop spontaneously in the stomach and duodenum of man.

The Jonah Story: Recent studies in this laboratory have shown quite conclusively that hydrochloric acid *per se* possesses no digestive capacity. The pH of the gastric juice obviously is of great moment in determining its digestive power. Comparative studies with hydrochloric acid and gastric juice of the same acidity serve to indicate that it is the peptic quality of the juice which determines its digestive capacity (24).

The opinion is gradually being forced upon us that the stomach is a very complicated organ. It is not only a source of pleasure to us but it can be a source of many difficulties, as every student of its problems learns to know. It certainly is a hematopoietic organ. It may well be an endocrine organ as well.

The observation that certain gastric cancers are not apeptic suggests to me that it might not be out of place to bring before you some observations which my associates and I have been making upon the digestive action of gastric juice. Let me tell you only briefly of some experiments which we have done upon frogs. If the small spring frog (*Rana pipiens*) is placed within the stomach of a large frog (*Rana castabiena*), it will be observed that within a period of six hours the small frog is almost completely digested; after twenty-four hours, a few bare bones re-

main. If, on the contrary, the experiment is done under similar conditions, only with the variant that the larger frog is cooled to $2^{\circ}\text{C}.$, it will be observed that no digestion has occurred within a period of twelve hours or more. In fact, the small frogs survive. When an oxygen line (No. 90 polyethylene tube) is placed to the nose of a frog implanted into the cold stomach of a dog, the frog is still alive at the end of thirty-six hours! When warmed up a bit, it revives, makes as long hops as before, and survives (25). The only creature in which the gastric pepsin is active at $2^{\circ}\text{C}.$ is the fish. Determinations on catfish, pike, and trout have served to confirm the observation that a small minnow placed in the larger fish, even at $2^{\circ}\text{C}.$, will be digested. At warmer temperatures, of course, the digestion proceeds more rapidly.

Local Gastric Hypothermia for Massive Gastric Hemorrhage: The foregoing observations serve to point up the possibility of arresting peptic enzyme activity in the management of acute massive gastric hemorrhage accompanied by hematemesis. To date 18 patients have been treated (26). Cessation of hemorrhage has been quite uniform following local cooling of the stomach achieved by circulating equal volumes of ice water and ethyl alcohol through a small balloon introduced into the stomach. The system is a closed one; a sigma-motor pump is employed to force the cooled fluid at 3 to $5^{\circ}\text{C}.$ through a small catheter into the balloon; the fluid returns from the stomach by gravity drainage through a tube of larger diameter. An electric microswitch signals the presence of a full balloon in the stomach and automatically shuts off the inflow periodically, thus preventing overdistention of the balloon. The temperature of the returning fluid is in the area of 10 to $14^{\circ}\text{C}.$ The patients are warmed peripherally to maintain a normal body temperature.

Operation to control hemorrhage has been necessary in only 1 of these 18 patients. In 3 of 4 patients with portal hypertension, local gastric cooling was

followed by cessation of hemorrhage.⁶ A considerably enlarged experience is necessary before the exact role of local hypothermia in the control of massive gastric hemorrhage will be known precisely. It is obvious, however, that it promises to be an agency with some merit. Moreover, the exact diagnosis of the cause of the hemorrhage is not necessary. Depression of peptic activity would appear to be desirable in all instances of massive gastric hemorrhage. One of the obvious advantages of local hypothermia is that with cessation of hemorrhage the vital signs stabilize and, should surgery be necessary, it can be performed with some of the advantages of an elective procedure.

ACQUISITION AND USE OF OTHER SKILLS

The contributions of roentgenologists to medicine in its many fields are great. The introduction of roentgenology gave medicine a great forward thrust on many fronts. Today it would not be possible to deliver a reasonably good brand of service to the public without access to this important agency. Medical specialism has come much to the fore during our lifetime. Many of the currently recognized specialties of medicine and its allied sciences were unknown during the student days of the older members of the group assembled here today. Then there had been no fission between diagnostic and therapeutic radiology. During the search conducted by Dr. H. S. Diehl, Dean of the University of Minnesota Medical School, and a Committee of his Faculty for a worthy successor to Dr. Rigler, who had chosen to retreat to the sunny climes of Southern California, we encountered more than once the attitude that the halcyon, golden days of diagnostic radiology had passed their zenith; that most, if not all, of the important diagnostic radiologic discoveries had already been

⁶ Since this presentation, my associates have arrested the massive hemorrhage of portal hypertension in a cirrhotic by local gastric cooling and performed directly thereafter a successful portocaval shunt as an emergency procedure.

made; that this branch of radiology as a tool of exploration was fast retreating into the limbo of a well earned obscurity; that hereafter the important future contributions would come from the field of therapeutic radiology.

There is little evidence of the saving grace of humility in such assertions, which came, as you have correctly surmised, from those who had abandoned a serious interest in diagnostic radiology. Similar comparisons and appraisals of the contributions from our respective spheres of interest to the public good are probably being made every day, wherever medical men congregate for exchanges of information, opinions, and pleasantries. In this connection, the instruction of the Great Master may well be remembered; said He: "For he that is least among you, the same shall be great."

If I may be so bold as to say so in this distinguished assembly, I would make a plea for a study of disease rather than a partition of interest on the basis of whether one is diagnosing or treating. As we look down the long and obscure fairways of the future, I have the feeling that it is the person who essays to learn all about a disease who is most likely to make an important contribution to its management. Whether it is our function to diagnose or to treat a disease, we should be earnest students of that disease: of its origins, its vagaries, and its manifestations, as well as of its recognition and treatment.

Your President, Dr. Rigler, while contemplating a career in radiology, took the long way around and did a tour of a year each in pathology and in internal medicine. Mind you, this was thirty-five years ago, when Board requirements did not loom as importantly on the horizon as now. In university circles in particular, I believe, it is time that we discarded some of the interdepartmental fences and barriers which separate us. I cannot believe that the interests of medicine are best served by limiting the activities or perspectives of persons engaging in a specialty. He who is blind to everything but that seen

through an endoscopic instrument will obviously reveal unmistakable traces of such myopia. Whether we diagnose or whether we treat, it seems to me it behooves us as practitioners of medicine to address ourselves broadly to the subjects which come under our purview. Any one of us who uses the tools of another specialty will, by its criteria, be adjudged an amateur. Yet the fusion of amateurish views from other segments of knowledge into the areas of our more direct concern is, I believe, in the best interests of medicine, and is most certainly of value in the exploration of new horizons.

John Hunter is an interesting study for anyone who would profess to make some contribution to the patrimony of knowledge. Hunter studied the teeth, the blood, gunshot wounds, digestion, and a host of other things, making important contributions to all. Our commitment to specialism, I fear, contracts our vision and makes us feel it is impossible to make a contribution to another area of scientific interest. The time is definitely overdue when the tools of our special disciplines should limit our interests. All of us, no matter what our specialty, can, I feel, make more significant contributions to our special areas of interest if we will address ourselves more broadly to an intensive study of the diseases which come to our attention, rather than limit our interests sharply to the use of those tools in which our special handicraft instructs us. In any case, I have the feeling that within every department, at least in university circles and teaching centers, there should be a few persons who scamper about the interphases of some of the diseases which come beneath the purview of that department.

Witness what has happened in the field of intracardiac surgery. Today in our clinic, it is the surgeon who deals intimately with its problems, who knows the anatomy of the heart most thoroughly. With the help of cardiac catheterization, he too is revising the diagnostic criteria of the internist in the recognition of cardiac dis-

orders. It is not the tool that the specialist has in his kit or shop but the knowledge which he carries in his head, the attitudes of his mind and the flights of his imagination—these are the tools which will break down interdepartmental barriers and sharpen the focus upon the problems which will continue to face us in the fairways of the future.

Medicine is a co-operative enterprise. Its ramifications in knowledge and fact are so enormous that one can encompass but a small segment of its vast domain. Radiology has contributed much to present-day accomplishments in cancer diagnosis and therapy. A few modern Josephs in the cloak of the radiologist, addressing themselves to the problem of cancer detection, which seems to hold the key to important future progress in cancer, could do a great deal to lessen the gloom and dispel the apathy which hovers over the gastric cancer problem. Perhaps a few beds at their disposal, for special studies in the hospitals of medical schools and medical centers, would be helpful in sharpening the focus of radiologists upon some cancer interphase problems.

CONCLUSION

As we contemplate the challenges of the cancer problem, we might do well to reflect upon the art of sailing as delineated in Ella Wheeler Wilcox's delightful poem entitled *The Winds of Fate*:

Some ships sail East, some ships sail West,
By the self-same winds that blow;
It is not the gales, but the set of their sails,
That determines which way they go.

Radiologists and surgeons must tilt their sails to catch the wind from whatever direction it blows, if their labors are to make a palpable impact upon the cancer problem in our time.

The effectiveness of the surgeon depends in large measure, in every sphere of his activity, upon the help he gets from the radiologist. Visceral surgeons, like myself, are greatly in your debt. For us, you are an indispensable *Vade Mecum*, a beacon light that warns us of dangerous

shoals and a friendly hand that leads us on the way. The accomplishments of surgeons owe much to the contributions and fruitful labors of radiologists. If, as in Old Testament times, a sign were needed, I would gladly pluck off my shoe, Dr. Rigler, and hand it to you now as testimony and evidence of a solemn pledge of unending co-operation, confraternity, and mutual interdependence between surgeons and radiologists.

Finally, I want to say it has been a great privilege for me to share with you the opportunity of doing homage to an illustrious leader in American radiology. We do well to cherish the memory of Dr. Russell D. Carman. He has a strong claim upon our gratitude.

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REFERENCES

1. PRUITT, F. W., WANGENSTEEN, O. H., GANTS, R. T., PALMER, E. D., AND BRICK, I. B.: Panel Discussion on the Management of Gastric Ulcer. *Am. J. Gastroenterol.* **24**: 347-371, October 1955.
2. WANGENSTEEN, O. H.: The Problem of Gastric Cancer. *J.A.M.A.* **134**: 1161-1169, Aug. 12, 1947.
3. FRIESEN, S. R.: The Silent Interval in Gastric Cancer; a Study of the Time Elapsing Before Reassertion of Symptoms in Patients with Microscopic Malignancy in the Proximal Line of Excision and Without Lymph-Node Metastases. *J. Nat. Cancer Inst.* **10**: 545-549, October 1949. Discussion pp. 550-553.
4. CARMAN, R. D.: Benign and Malignant Gastric Ulcers from a Roentgenologic Viewpoint. *Am. J. Roentgenol.* **8**: 695-704, 1921.
5. COHN, I.: Giant Ulcers of the Stomach. *Am. J. Gastroenterol.* In press.
6. STEWART, M. J.: Ulcer-Cancer of the Stomach (Carcinoma Ex Ulcere Ventriculi). 1953 Macewen Memorial Lecture. Glasgow, Jackson, Son & Co., 1955.
7. SPRIGGS, E. I., AND MARXER, O. A.: Polyp of Stomach and Polypoid Gastritis. *Quart. J. Med.* **12**: 1-60, January 1943.
8. HAY, L. J.: Polyps and Adenomas of the Stomach. *Surgery* **33**: 446-467, March 1953.
9. HAY, L. J.: Surgical Management of Gastric Polyps and Adenomas. *Surgery* **39**: 114-119, January 1956.
10. HITCHCOCK, C. R., SULLIVAN, W. A., AND WANGENSTEEN, O. H.: The Value of Achlorhydria as a Screening Test for Gastric Cancer; a 10-Year Report. *Gastroenterology* **29**: 621-628, October 1955.
11. MORSON, B. C.: Carcinoma Arising from Areas of Intestinal Metaplasia in the Gastric Mucosa. *Brit. J. Cancer* **9**: 377-385, September 1955.
12. MORSON, B. C.: Gastric Polyps Composed of Intestinal Epithelium. *Brit. J. Cancer* **9**: 550-557, December 1955.
13. GUTMANN, R. A., BERTRAND, I., AND PÉRISTIANY, T. J.: Le cancer de l'estomac au début;

étude clinique, radiologique et anatomopathologique. Paris, Gaston Doin & Cie, 1939.

14. NAKAYAMA, K.: Personal communications, August 1958.

15. KEEN, W. W.: Address in Surgery. J.A.M.A. 28: 1102-1110, 1897.

16. YONEHIRO, E. G., ROOT, H. D., PERRY, J. F., JR., MARVIN, J. F. AND WANGENSTEEN, O. H.: Detection of Minute Gastrointestinal Bleeding Utilizing Radioactive Iron, Fe⁵⁹. Proc. Soc. Exper. Biol. & Med. 98: 339-341, June 1958.

17. ARHELGER, S. W., LOBER, P. H., AND WANGENSTEEN, O. H.: Dissection of the Hepatic Pedicle and Retropancreaticoduodenal Areas for Cancer of the Stomach. Surgery 38: 675-678, October 1955.

18. WANGENSTEEN, O. H., GRIFFEN, W. O., JENSON, C. B., AND ARHELGER, S. W.: The Accomplishment of the Second-Look Procedure in the Control of Gastrointestinal Cancer and Retroperitoneal Sarcomas. Presented at the Seventh International Cancer Conference, London, England, 1958.

19. SHAHON, D. B., AND LUNDSETH, J. B.: Observations on Accomplishments in Gastric Cancer, 1958. Unpublished.

20. SHAHON, D. B., HOROWITZ, S., AND KELLY,

W. D.: Cancer of the Stomach; Analysis of 1,152 Cases. Surgery 39: 204-221, February 1956.

21. CREECH, O., JR., KREMENTZ, E. T., RYAN, R. F., AND WINBLAD, J. N.: Chemotherapy of Cancer; Regional Perfusion Utilizing an Extracorporeal Circuit. Ann. Surg. 148: 616-632, October 1958.

22. SALMON, P. A., GRIFFEN, W. O., IMAMOGLU, K., PATTERSON, J., FATTAH, F., AND WANGENSTEEN, O. H., 1958. Unpublished.

23. WANGENSTEEN, O. H.: Retrospective Gastroscopic Glimpses; Studies in the History of Gastric Digestion. AOA Lecture, University of Minnesota, May 8, 1958. Unpublished.

24. WANGENSTEEN, O. H., ROOT, H. D., JENSON, C. B., IMAMOGLU, K., AND SALMON, P. A.: Depression of Gastric Secretion and Digestion by Gastric Hypothermia: Its Clinical Use in Massive Hematemesis. Surgery 44: 265, August 1958.

25. SALMON, P. A., GRIFFEN, W. O., IMAMOGLU, K., AND PATTERSON, J., 1958. Unpublished.

26. WANGENSTEEN, O. H., ROOT, H. D., SALMON, P. H., AND GRIFFEN, W. O.: The Emergency Treatment of Massive Upper Gastro-intestinal Hemorrhage by Local Gastric Hypothermia. To be presented at the American Medical Association meeting, Dec. 2, 1958, Minneapolis, Minn.

SUMMARIO IN INTERLINGUA

Remarcas Relative A Cancere, Al Secretion Gastric, E A Altre Cosas

Nostre speros con respecto al futuro de cancro gastric, como etiam de altere formas de cancro visceral, depende de methodos de detection precoce. Isto require le disveloppamento de nove procedimentos diagnostic que rende possibile le recognition del morbo durante le circa duo annos del intervallo silente ante le apparition de symptomas manifeste.

Si o non ulcres gastric pote resultar in cancro es un question controversa. Le proportion de cancro gastric que se disveloppava in un pre-existente benigne ulcere ha essite estimate a 17 o 20 pro cento. Altre precursores de cancro gastric es gastric polypos e achlorhydria. Es pur folia continuar reguardar un ulcere como benigne sin determinar per analyse gastric si o non achlorhydria es presente.

Le roentgenologia es le base major del diagnose de cancro gastric, ben que technicas que assecura le detection de omne defecto gastric ha non ancora essite disveloppate. Altre auxilios del diagnose es gastroscopia e studios cytologic. Si tosto que symptomas se ha disveloppate, le percentage de curationes es basse. Nulle operation del toto o mesuras solmente palliative esseva interprendite in 53,7 pro

cento del 310 casos vidite al Centro Medica Minnesota durante le quinquenne periodo ante le anno 1954.

Le plus radical forma de chirurgia que es ancora compatibile con le desiderato de un basse mortalitate operatori representa le melior forma de tractamento in casos de cancro gastric. Es sublineate le desirabilitate de un complete excision del integre area de drainage lymphatic del stomacho, con ablation del nodos lymphatic ab le pediculo hepatic e le area retro-duodenal.

Trenta-cinque patientes con nodos lymphatic originalmente positive pro cancro esseva subiecte a 54 operationes re-examinatori e se revelava como albergatores de residuos de cancro. Ex illes, 3 esseva emancipate ab cancro per re-operationes.

Cento cinquanta e sette patientes con cancro gastric, vidite inter le 1 de januario 1936 e le 1 de januario 1954 al clinica del autor, superviveva al resection cinque annos o plus. Le tumores includeva 150 carcinomas, 1 leiomyosarcoma, e 6 lymphosarcomas. Tres quartos de iste superviventes habeva lesiones de plus que 4 cm de diametro, ben que on dice que le cura-

tion es plus probable quando le lesion es micre. Le superviventia quinquenne pro omne le patientes qui se presentava al observation con diagnoses de cancre gastric durante iste periodo esseva 14,7 pro cento. Le superviventia inter patientes con negativitate del nodos lymphatic al tempore del resection esseva 42,3 pro cento.

Es etiam discutate certe studios functional del secretion gastric, incluse le dissociation del secretion de acido hydrochloric e de pepsina e le qualitate peptic del succo gastric. Post studios experimental relative al effecto del temperatura

super le action digestive, local hypothermia gastric esseva usate con bon resultatos therapeutic in le subjugation de massive hemorrhagias gastric in 18 patientes. Experimentias additional es requirite ante que le rolo precise de hypothermia local pote esser recognoscite definitemente.

Le reporto conclude con un discussion del contributiones de varie specialitates al problema del diagnose de carcinoma del stomacho. Le medicina es un interpresa cooperatori, e forte argumentos es formulate contra le division de sphas de interesse secundo le varie specialitates.



Congenital Insensitivity to Pain: A Neurologic Syndrome with Bizarre Skeletal Lesions¹

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THE REACTIONS OF bone to trauma are well known; even when the traumatic episodes have been unrecognized, forgotten or denied, the evidence provided by roentgenographic examination of the skeleton frequently permits unequivocal diagnosis and subsequently elicits the confirmatory history (4, 26, 28). Thus, custodians of children may be made objectively aware of the fact that certain activities can be traumatic for their charges. In rare instances, failure to recognize a traumatic basis for bizarre roentgenographic appearances of bones results from subjective rather than objective deficiencies; the patient and not his custodian is, in effect, unaware of the trauma.

Unawareness of trauma associated with a congenital indifference or insensitivity to pain was responsible for the unusual skeletal lesions observed in the two sisters reported below. No satisfactory explanation for the clinical and radiographic findings was available until we learned of the syndrome through Murray's report (21) eight years after our initial contact with the patients. About the same time, the comprehensive review of Fanconi and Ferrazzini (10) made its appearance and was followed shortly by the report of Lamy *et al.* (18). The increasing number of prior reports unearthed successively by the several authors supports the belief that congenital insensitivity to pain is a distinct syndrome of variable severity and that our two patients, whose disability had been undiagnosed previously, properly belong in this nosologic category. The similarity of the clinical manifestations in all reported instances is remarkable even with the diverse expressivity of the disease; the



Fig. 1. Case I. S. E. 12-year-old female. Right elbow 7-18-49. Deformity resulting from fracture of radius with separation of head from shaft and non-union. No known antecedent injury.

roentgenographic appearance in such instances where illustrations of skeletal lesions are available are more variable, but are adequate to stimulate appropriate clinical inquiries and examinations. The roentgenographic similarities between Murray's illustrations and the films of our cases led to the specific questioning and examinations which established the diagnosis.

CASE REPORTS

The two patients were seen together initially, but the reports will be presented in part separately. The older sister (Case I), now twenty-one years old, has refused to be interviewed and the data which refer to her are taken from the hospital chart or from information provided by other members of the family.

CASE I: S. E., a white female, was twelve years of age when first seen in the Children's Hospital Out-patient Department because of skeletal deformi-

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Fig. 2. Case I. Deformity and shortening of right femur, 6-29-49, partially resulting from earlier osteotomy. Note remnants of original shaft at site of angulation.

ties. She was born at term after an uncomplicated seventh pregnancy of a thirty-year-old mother. Her father was thirty-five years old at the time of her birth. Delivery was normal. Development proceeded normally and the child had the usual childhood diseases without complications. At the age of two years, there occurred a convulsion in association with high fever. The routine immunizations had been given at the usual times. Dietary history was not remarkable, although supplementary vitamin preparations were offered only irregularly.

At six years of age, the parents noted a bony swelling in the region of the right knee and took the patient to a hospital, where a diagnosis of "rickets" was made on the basis of x-ray examination. She was given cod-liver oil for one year, with no appreciable change in the bony deformity. At the same time the family was told that a large "exostosis" was responsible for much of the deformity.

At the age of nine, the patient was readmitted to the same hospital. Once again the diagnosis of "rickets" was made, according to the parents, though a review of the hospital record (1946) discloses no mention of rickets but a diagnosis of "congenital varus angulation of the right knee with overgrowing bone, cortex of the condyle, femur." A corrective supracondylar osteotomy was performed. Because of the residual deformity and the appearance of comparable deformities in her younger sib-



Fig. 3. Case I. Detail of right knee illustrating spontaneous obliteration of epiphyseal line, 7-18-49. Frontal and lateral projections.

ling, the patient was brought to Children's Hospital in 1949 at the age of twelve years.

Physical examination revealed a poorly nourished girl, with a pronounced valgus deformity of the enlarged right knee. Harrison's groove was said to be present. Extensive scarring was described over the anterior surface of the legs. The nails were thickened and vertical grooves were noted in the teeth by a dermatological consultant. The teeth were described as foul, and the gums bled easily. The child was said to be "double-jointed"; she could clasp her hands behind her back and, without letting go, bring her arms over her head and her hands in front of her. She could also do a "split" with ease.

A routine hemogram and urinalysis were not remarkable. The only blood chemistry report was a total protein of 6.8 gm. per cent.

X-ray examination at twelve years of age showed no evidence of rickets or exostoses. There was, however, an irregularity of mineralization in the right radial head which was considered the result of prior trauma, *i.e.*, fracture with nonunion (Fig. 1), and deformity was noted in the distal end of the right femur (Figs. 2 and 3). The deformity consisted in a medial inclination of the distal few inches of the femoral shaft while the remnants of the epiphyseal line ran parallel to the proximal epiphyseal line of the tibia. The major portion of the epiphyseal line was prematurely obliterated and the bony architecture in the involved portion of the shaft was distorted. The right femur was several centimeters shorter than the left. A slight disturbance of tubulation was present in the proximal portion of the tibial shaft. The distal interphalangeal joint of the middle finger of the left hand was irregular and the affected phalanges were held flexed.

Review of films taken in 1945 and 1946 (one year before the osteotomy and at the time of osteotomy,



Fig. 4. Case I. Knees 11-14-45. Note irregularity of distal femoral metaphysis.

respectively) revealed no signs of rickets. In November 1945 (Figs. 4 and 5) the right knee was actually in valgus deformity as a result of an apparent undergrowth at the lateral portion of the metaphysis in comparison with the medial portion. The epiphyseal line was grossly irregular; several islands of bone or calcifying cartilage lay in the irregular radiolucent portion, and the radiolucency extended up onto the posterolateral portion of the shaft, as if bone had been replaced by nonmineralized tissue. The cortex extending down to the "defective" area, however, became progressively thicker from above downward so that the defect in reality represented an area in which external cortical new bone formation was not present. The distal epiphysis tended to line up with the outer border of the external cortical thickening, much as would occur in a healing epiphyseal displacement. Wherever the end of the shaft approached the irregular epiphyseal line, the bone was increased in density. The other epiphyses and epiphyseal lines of the knee were normal.

The films of the right elbow in November 1945 demonstrated an old ununited fracture of the radial head with two free fragments, possibly representing a remnant of the head and a bit of subjacent shaft.

At the time of the osteotomy in November 1946, the irregularity in the distal epiphyseal line of the femur had resolved largely, although the valgus relationship of the epiphysis to the shaft was maintained (Fig. 6). The posterolateral radiolucent area had filled in with dense bone. There was an early suggestion of the premature epiphyseal union which was later to be distinct. The supracondylar osteotomy (Fig. 7) was intended to correct the deformity and adequately accounted for the configuration of the distal portion of the femur when we first saw the patient three years later.

No definitive diagnosis was established at the time



Fig. 5. Case I. Right knee 11-14-45. Oblique projection. The degree of epiphyseal separation is best appreciated by projecting downward the internal surface of the cortex.

of our examination in 1949. Noting the relaxation of ligaments and the papyraceous scars over the legs, orthopedic consultants favored a form of the Ehlers-Danlos syndrome. A dermatologic consultant did not concur. He felt that the cutaneous lesions were not consistent with that diagnosis. In addition, he believed the disturbance of the nails to be traumatic rather than dystrophic. He also noted a mild perlèche, an atrophic tongue, and vertical grooves of the teeth which he considered to be a dental disturbance.

The patient was next seen in the Out-patient Department five months later because of swelling of the left ankle. Twelve days earlier she had fallen while playing and "cracked her left foot." Swelling began immediately and involved the entire left foot and the distal three-fourths of the leg. The swollen area turned blue and gradually changed to brown. A physician diagnosed a sprain and recommended magnesium-sulfate soaks. Under this treatment the discoloration receded but the swelling persisted. The patient continued to use the swollen extremity, although she admitted discomfort above the ankle. On physical examination, the swelling and discoloration were obvious. The patient was unable to

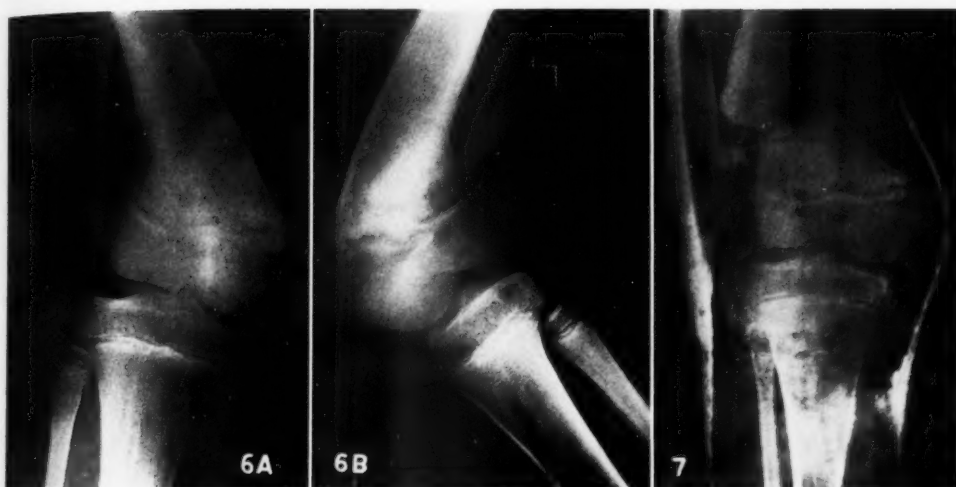


Fig. 6. Case I. Right knee 11-8-46. Spontaneous healing of the displaced epiphysis and fragmented metaphysis. A. Frontal projection. B. Oblique projection.

Fig. 7. Case I. Right knee, 11-9-46, in cast after osteotomy. Compare with configuration of femur in Fig. 2.



Fig. 8. Case I. Left ankle 12-19-49, twelve days after injury. Patient had been walking. A. Frontal projection. Arrows indicate overlap of bone. B. Lateral projection.

Fig. 9. Case I. Left ankle 2-27-50. Typical hyperostotic reaction following injury with inadequate immobilization. A. Frontal projection. B. Lateral projection.

abduct her foot, but other movements of the ankle joint were present. In dorsiflexing the ankle, an audible and palpable click was noted over the posterior aspect of the distal end of the left tibia. One examiner elicited tenderness over the gastrocnemius muscle, but pain as a complaint or during examination was impressively absent in view of the x-ray findings.

Roentgen examination of the ankles disclosed an epiphyseal separation at the distal end of the left tibia (Fig. 8). A triangular fragment of the shaft was attached to the displaced epiphysis; movement of these structures undoubtedly accounted for the "click" noted on physical examination.

Healing took place promptly after application of a cast, considerable calcified callus making its ap-

pearance (Fig. 9). The patient was ambulatory all this time. There was no complaint of pain and, although she had been cautioned not to bear weight after removal of the cast, she had complied by walking on her toes. Clinic visits over the next eight months were related to carious and abscessed teeth, all of which were ultimately extracted. Extractions, including impacted molar teeth, were done under local anesthesia. At no time does the chart mention pain or discomfort connected with these procedures other than episodes of pain associated with cellulitis of the face and other evidences of infection on several occasions (Fig. 10). During one of the extractions, an ulcerous lesion on the tip of the tongue was biopsied. The lesion had not been painful. Histologic sections were reported to show



Fig. 10. Case I. Dental caries and sepsis, 4-12-50. The alveolar atrophy is a consequence of dental extractions, and is not a manifestation of ectodermal dysplasia.

chronic inflammation. Following the dental treatments, there was no further contact with the patient. Additional information obtained from her sibling is reported in the discussion of the two cases.

CASE II. P. E., a younger sibling of the patient described in Case I, was first seen in the Children's Hospital Out-patient Department at the age of nine years, on the same day as her sister, because of similar skeletal deformities. As in the case of her sister, birth and development had been normal and the usual childhood diseases had evolved without complication. Dietary history was not remarkable; supplemental vitamins had been offered only irregularly. At the age of six months, a diagnosis of rickets was made when the child was being treated for pneumonia. Like her sister, she was said to have exostoses, in this instance in the region of the left knee and right foot. She was treated with oleum percomorphum for six weeks and received no other vitamin preparation until three years prior to this visit when the diagnosis of rickets was made on her older sibling. The younger sister was subsequently given cod-liver oil for six months to one year. Medication was discontinued when no obvious benefit was noted.

On physical examination at nine years of age, the patient was found to be undernourished and poorly developed. A slight dextroscoliosis was noted. Scars of recent and old scratches and abrasions were present over the extremities. A valgus deformity of the right knee was present. Both knees, the right ankle, and both wrists were knobby and enlarged (Fig. 11). The medial prominence of the right knee gave the clinical impression of an exostosis. An irregular swelling was present over the right clavicle. A routine urinalysis and hemogram were normal. Total protein of the serum was 6.6 gm. per cent.



Fig. 11. Case II. P. E., younger sister of S. E. (Case I) when first seen, at the age of nine years (1949). Note scars on knees; enlargement and deformity of right ankle, both knees, and wrists; swelling over right clavicle.



Fig. 12. Case II. Femurs 6-29-49. The shaft of the left femur is expanded, simulating a fibrous dysplasia. Note the epiphyseal displacement in the right femur at the knee.

X-ray examination at nine years of age showed changes similar to those in the older sister. There was a shortening of the left femur with disturbance of tubulation distally, due to medullary expansion, and a lateral inclination of the distal third, at least, in relation to the proximal two-thirds of the shaft (Fig. 12). The distal epiphyseal line of the right femur was irregular. The tibia appeared to be subluxated on the femur and the patella was displaced laterally. At the distal end of the right tibia, a disturbance of trabecular structure was present, associated with medullary expansion and lateral inclination of the distal 2 to 3 inches of the shaft (Fig. 13). Later questioning elicited the history of an ankle fracture at three years of age. The bone was irregularly rarefied and sclerosed in the involved area. The epiphyseal line was irregular. The fibula participated in the angulation deformity, so that the horizontal plane of the ankle joint was in valgus relationship with the main portion of the tibial shaft. There were no pathologic changes in the elbows, in contradistinction to observations in the sister, but a pseudarthrosis with opposing sclerotic edges of bone was present in the right clavicle (Fig. 14).



Fig. 13. Case II. Ankles 6-29-49. In the right tibia, a fibrous dysplasia is again suggested.



Fig. 14. Case II. Chest 7-1-49. Note pseudarthrosis of right clavicle.

Subsequent history disclosed a fracture at seven years of age following a fall. There had been little disability connected with the injury, but swelling and redness were present.

As in the case of the sister, consultants did not agree on the diagnosis. Marked relaxation of the ligaments (Fig. 15) was noted. The dermatologist did not feel that the findings represented those of conventional cutis laxa. All were agreed, however, that the two girls had the same disorder, which was considered dystrophic in nature, and that they differed appreciably from their siblings.

Approximately six months after the initial visit, the younger sister was admitted to the hospital for osteotomy of the left femur. At that time, roentgen changes in the right femur at the knee (Fig. 16)

were surprisingly similar to those noted in the older sister five years earlier (Fig. 4). The day following osteotomy, the patient stated that she felt uncomfortable but she had no specific complaint. Pain in the leg is mentioned in the chart, but there is no record of medication on this account. Three and one-half weeks later, an osteotomy was done on the right femur.

Five days after the second procedure, a temperature elevation to 101° was observed without obvious cause; a booster injection of diphtheria-pertussis-tetanus vaccine the day before was considered responsible. A week later, however, when the cast was changed, a pressure sore was found and in retrospect was assumed to account for the febrile episode. Although the size of the pressure area is not stated, a full month elapsed before healing was complete. At this time, the orthopedic resident (Dr. Joseph Barnhart), impressed by the lack of complaint on

to deep probing. Corneal reflexes were almost absent; what remained was thought to be due to visualization of the approaching wisp of cotton. The deep reflexes were absent in the biceps but were normal in both triceps; knee and ankle jerks could be tested only in the left lower extremity, because of the cast, and were normal.

The neurology consultant felt that the reactions of the patient were part of a heredofamilial disorder. He did not believe that the lack of perception or conception was due to mere stoicism. The child did not impress him as being stoical in other ways.

The patient subsequently was transferred to the Children's Convalescent Home, until her next admission for transplantation of the patellar tendon.

Laboratory findings during the initial hospital admission included the following: hemoglobin varied between 10.8 and 12.3 gm./100 c.c.; red blood cells numbered 4.37 to 4.44 million per c. mm. with 27.9



Fig. 15. Case II. Laxity of ligamentous structures (or overstretching due to lack of pain) permits contortion of body.

the part of the child during the preceding period, and aware of the condition of her sister, whose ankle fracture was now healing, questioned the children's mother in some detail. He elicited the statement that these two girls were singularly alike and distinctly different from their siblings. The astute observation was made that "these two girls do not feel or do not express their feeling for pain." In support of this impression was the admission by the mother that the two children never complained of the most severe burns, cuts, or bruises. Unfortunately, this information was interpreted to support the diagnosis of the Ehlers-Danlos syndrome.

At the request of the orthopedic resident, the patient was examined during her convalescence from the osteotomies by a neurologist (Dr. Park Biehl). Pinprick produced less pain and much less reaction than expected. The child did not seem to fear the pin. The perception of light touch was acute, and sensations of vibration and position were intact. No response was elicited to tickling the soles of the feet, but the ribs were thought to be questionably ticklish

micromicrograms of hemoglobin/RBC; platelets were 200,000/c.mm.; there were 8,000 to 12,000 white cells per c.mm., with a normal differential count. The erythrocyte sedimentation rate (Wintrobe) was 50 mm. in one hour and corrected to 37 mm. in one hour. Prothrombin time was 19.8 seconds. Bleeding time was 4 minutes and 30 seconds; clotting time was 3 minutes and 30 seconds. A Rumpel-Leede test was positive, twenty petechiae being counted in a 1-square-inch area below the tourniquet. The basal metabolism rate was plus 12 per cent. Several routine urinalyses were normal. The calcium content of the serum was 10.6 mg. per 100 c.c., the inorganic phosphorus was 3.7 mg. per 100 c.c., and the alkaline phosphatase level was 11.1 Bodansky units. Total protein measured 6.6 gm. per 100 c.c., of which 4.2 gm. were albumin and 2.4 gm. globulin. The cholesterol content was 192 mg. per 100 c.c. A vitamin C level was 1.55 mg. per 100 c.c. All of several stool cultures were negative for pathogens. Fluid aspirated from the right knee joint was normal on culture. Skin biopsies obtained



Fig. 16A. Case II. Knees 1-9-50. Frontal projection. Beginning aseptic necrosis-like lesion in left lateral femoral condyle and medial tibial condyle. Note resemblance of epiphyseal separation and metaphyseal fragmentation of right femur to that in Case I (Fig. 4).



Fig. 16B. Case II. Knee 1-9-50. Lateral projection.

at the time of osteotomy, and subsequently under local anesthesia, showed no abnormalities. An electrocardiogram was read as normal.

At the time of admission for the tendon transplant, after one month at the Convalescent Home, a pediatric intern remarked that the child "seemed anesthetic to pain of needle prick." Following surgery, there is one notation of mild pain in the knee, but no sedatives or narcotics were required. The child was discharged home one month after surgery, ambulatory in a sleeve cast. Biopsy of skin, synovia, and bone, obtained during the transplantation procedure, showed no recognizable abnormalities.

The next admission was three months later because of swelling, pain, and erythema in the left ankle of four days duration. The patient had been walking for three days without the crutches which were given to her to use on discharge. There had been occasional pain in the left knee, but only when the child was sitting. The left great toe was also "painful" on occasion. Physical examination revealed swelling and erythema of the left ankle with slight limitation of motion and tenderness. Fluid was present in the left knee joint. There was no history of trauma. Roentgen examination of the ankle was normal and the clinical signs disappeared on rest and local heat treatment. A brown discoloration persisted over the ankle for several months. The clinical impression was cellulitis of the ankle. A roentgenogram of the knee (Fig. 17) demonstrated an aseptic necrosis-like lesion in the lateral condyle of the femur.

In December 1951, one year after the last admission, the patient slipped on an icy street and fell, sustaining a fracture of the shaft of the left femur. The patient felt her leg "snap" and subsequently stated that there was an immediate numbness of the entire lower extremity from the hip down. She

attributed the lack of pain or discomfort with which she bore this injury to the numbness. No notation of neurologic deficit is noted in the chart. X-ray examination revealed a long oblique fracture through the middle third of the shaft. Treatment was by balanced skeletal traction. Despite an associated hemarthrosis of the left knee which yielded 50 c.c. of blood on aspiration, there is no notation of discomfort in either the doctors' or nurses' notes. In fact, the day following injury, a resident wrote: "Today patient seems in good spirits. Is being maintained well in traction. Has no complaints. . . ." Healing was prompt and adequate.

A month after discharge from the hospital, the patient was readmitted for a derotation osteotomy of the left tibia. A statement concerning the relative lack of postoperative pain appears in the chart. Five months later, there was a complaint of pain in the left knee with "catching" on going up or down stairs. The knee was unstable and crepitations were palpable and audible. A patellectomy was undertaken. Some synovia was removed, together with the left lateral meniscus and some fibers of the anterior cruciate ligament which were loose and macerated. Histologic examination of removed



Fig. 17. Case II. Left knee 11-10-50. Aseptic necrosis-like lesion of lateral condyle is quite prominent. Radiolucent defect in tibia is thought to be residual to skeletal traction after osteotomy, but low-grade osteomyelitis could not be excluded. Frontal and lateral projections.

tissue was consistent with degenerated articular cartilage, loose bodies, and pigmented villonodular synovitis.

Eight months later, at the age of thirteen, while running, the patient fell and sustained a fracture of the left femur just above the knee. Again notation is found "... thin co-operative white female who does not complain of pain in spite of her fracture." Healing took place with traction. The patient was not seen again until a year and a half later, when increasing difficulty in ambulation because of deformity and pain in the left knee led her to seek medical attention. At this time, there was marked instability in the knee with crepitus, and arthrodesis was performed. Despite some postoperative slipping of the opposing bone surfaces, and a wound dehiscence, no indication of pain is noted in the record. An ulceration developed in this area and was thought to represent the site of cast pressure. Two skin grafts were ultimately necessary to close the area. The last admission, at the age of sixteen, which age precluded further admissions to Children's Hospital, was for removal of a bony protuberance over the site of the medial femoral condyle which interfered with walking and was uncomfortable from pressure of bedclothes.

The patient, now eighteen years of age, is ambulatory but restricted in movements because of her knee fusion. She has had no serious injuries recently, but still tends to fall easily, a fact which she now attributes to her limitation of left leg motion. She is alert, co-operative, and friendly. Her nose is somewhat coarse and irregular. She believes this is a result of scars from picking at her nose as a small child. Careful neurological examination by Dr. Park Biehl, who examined the patient seven years earlier, reveals no neurologic deficit other than a

distinctly diminished sensitivity to pain. Stimuli which generally provoke severe pain responses are described as "uncomfortable." The patient tends to withdraw from them but, when instructed not to, controls her reaction completely. No pupillary reaction or facial response is noted. She believes she is more sensitive to pain than she was as a child.

FAMILY HISTORY

The two sisters were the seventh and eighth children born to their parents. The pedigree is represented in Figure 18. Pertinent information is that the parents were second cousins, the mother's father and the father's grandmother being brother and sister. The father's parents were reputed to be third cousins. It is said that 2 paternal brothers and 2 paternal sisters had "rickets" and that they were "double-jointed," like our two patients. One of the mother's brothers had 2 children, 1 of whom was epileptic; another brother and a sister each had 7 children, all of whom were said to be healthy. A third brother had no children. The father had 9 brothers and 4 sisters. All except 2 were married and had children, none of whom were said to have any complaints similar to those of their 2 cousins. The patients' mother was known to have cardiospasm and definite dysphagia and was said by the dermatology consultant to have a non-dystrophic type of ichthyosis bullosa and congenital ichthyosis. Other disease history was lacking in the numerous members of the family.

CLINICAL SUMMARY

The two sisters, who differ from their siblings, gave a history of recurrent skeletal injuries requiring extensive orthopedic treatment. Both appear to suffer little from conditions and procedures which ordinarily would be extremely disabling. The elder sister walked on a fractured ankle for twelve days before persistent swelling led to medical consultation. X-ray examinations at various times revealed evidence of abnormal bone in the right knee and the right elbow consistent with old trauma, but originally incorrectly interpreted as a manifestation of skeletal dystrophy. The

younger sister had similar deformities and incurred two relatively painless fractures after adequate trauma during the period of observation. Several major surgical procedures were undertaken to correct the deformities. On several occasions, pain or discomfort was a presenting complaint, but the development of postoperative sores was recognized only objectively on removal of casts, and other complaints of pain were conspicuously lacking.

Because of extreme hypermobility of joints and questionable increased elasticity of the skin, the children were thought to be afflicted with an incomplete form of the Ehlers-Danlos syndrome; because an adequate explanation of the skeletal changes was not immediately forthcoming, these too were considered the result of an ill-defined dystrophy. The publication of a case report with radiographic changes similar to those in the two girls led to the recognition of the condition as a congenital insensitivity to pain, although an astute observer had recognized the sensory disturbance some years earlier but considered it to support the diagnosis of Ehlers-Danlos syndrome.

DISCUSSION

Previously reported cases will not be discussed in any detail; the interested reader will find excellent reviews in reports by Fanconi and Ferrazzini (10) and of Lamy and associates (18). Murray (21) in 1956 mentioned 11 previous cases and added 1 of his own. Fanconi and Ferrazzini in 1957 tabulated details of 32 prior cases, not including Murray's, and added 3 new examples. Lamy and his co-workers, in 1958, were able to find 42 previously published cases, still omitting Murray's, and added 1 case. There are therefore data on 46 instances of this syndrome, including the 2 here described. Similarity of clinical signs and symptoms and of the radiographs when described or illustrated is most remarkable. Variations are apparently the result of diverse clinical expression of the insensitivity to pain. They are even possible in the same individual at different ages. Fanconi

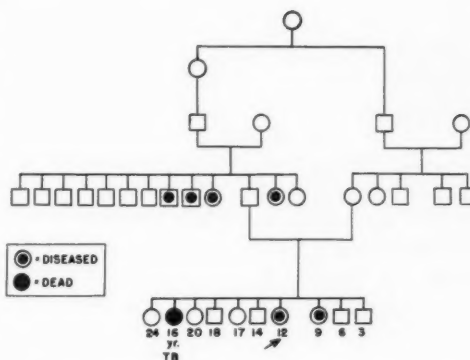


Fig. 18. Pedigree of family. Arrow indicates patient No. 1; The 9-year-old affected sibling is patient No. 2; The uncles and aunts indicated as "diseased" were said to be double-jointed and to have had rickets.

and Ferrazzini emphasize the usual improvement with advancing age, as if sensitivity to pain matured and/or was assisted by a substitution of other sensory mechanisms. The most severe forms are generally seen in infants and children. From perusal of readily available reports (1, 3, 5-13, 15-23, 25, 27) and the reviews by Fanconi and Ferrazzini (10) and by Lamy *et al.* (18), the usual development of the manifestations can be summarized as follows:

The syndrome is commonly heralded by severe biting of the tongue and lips as soon as the first teeth make their appearance. Fingers may also be badly bitten, and mutilated. The teeth are commonly lost early, due to dental sepsis, as was observed in both our patients. Ordinary and severe cuts, burns, and bruises are frequent and may heal poorly, leaving prominent scars. Corneal opacities may result from trauma or foreign bodies in the eye (21). Local swellings and redness occur in the neighborhood of joints; it is often difficult to determine whether these are primarily traumatic or whether they are infectious. Not infrequently, x-ray examinations of the affected area show fractures and epiphyseal separations in various stages of repair and, on occasion, focal metaphyseal radiolucencies with sclerotic borders which actually represent foci of osteomyelitis. Hospital admissions are fre-

quent, largely for treatment of orthopedic problems and their correction.

Except for the insensitivity to pain, which often passes unnoticed, no outstanding neurological signs and symptoms are present. Deep and superficial tonic reflexes are usually intact and no pathologic reflexes are found. We have observed one patient, not reported here, who failed to show any respiratory response to sudden, forceful rectal dilatation while coming up from very light anesthesia. Corneal reflex is variable, but more commonly absent or diminished than present. Variability in reported cases may be related to the degree of co-operation exhibited by the patient. Our patient No. 2 would blink at the approaching wisp of cotton and appear to have an active corneal reflex; however, when she was instructed not to blink, the eye was held open without obvious strain while the cotton was moved back and forth across the cornea. In some instances, the gag reflex has been lacking or impaired. Tests for all modalities of sensation except pain are usually normal. Our patient No. 2, however, was relatively anosmic when tested recently, appreciating only strong smells, possibly due to unremembered nasal injury. Mention of taste and smell is seldom made in the reported cases or the reviews; however, where studied, these sensations have not been grossly disturbed. Jewesbury's (15) patients took large mouthfuls of mustard or horse-radish sauce without discomfort. Sensitivity to tickling and to pruritus is irregularly disturbed. Some patients are not ticklish at all, some respond to rib-tickling but not to tickling of the soles, while others have a normal reaction. Pruritus can occur but is usually absent. Our patient No. 2 was not bothered by insect bites or dermatitis venenata, even when the visible cutaneous reactions were as prominent as in her non-analgesic siblings. Intelligence is usually unaffected, and gross psychic aberrations seem to play no part.

The outstanding feature is the absence or marked diminution of the sense of pain. This is evidenced by the patient's state-

ments, by his actions, and by the inability to provoke objectively recognizable physiologic reactions to pain (19). In a few patients carefully tested (10, 17, 19), little or no change was noted in pupillary dilatation, blood pressure elevation, rising pulse, or respiratory rate in response to ordinarily painful stimuli. Even when sensations of discomfort or rare episodes of pain are present (e.g., abdominal pain, headache, etc.), affective reactions appear to be damped or lacking. It is quite possible that the marked joint laxity exhibited by many patients represents the lack of warning that structures are being overstretched. We have been told that, when as a child patient No. 1 was spanked, she did not cry. Her mother would cry, partly because of exasperation at the child's lack of reaction but also because of pain in her own hand, but the child did not appear to suffer. Corporal punishment failed to make Murray's patient cry (21); this lack of reaction was also noted by Arbuse *et al.* (1) and by Farquhar and Sutton (11).

The disturbance of pain sensation is of variable degree. Our patient No. 1 seems to have a more profound disturbance than patient No. 2. She repeatedly burns herself while working in her kitchen at home. The burn is appreciated only when a blister forms. Some unaffected members of the family believe she burns herself deliberately, but from the reported experiences of other individuals it would seem that she does not appreciate the extreme degree of heat of, for instance, the handle of a frying pan, although she does appreciate that it is warm, and perhaps warmer than other objects. Patients with similar degrees of analgesia are reported to be able to discriminate differences in temperature as accurately as nonanalgesic individuals. The fact that patient No. 1 continued to walk on her fractured ankle for twelve days is reminiscent of Westlake's patient (27), who complained of inability to jump over a tennis net as well as usual and was found to have a subtrochanteric fracture of the femur with marked callus formation. Other reported incidents are equally un-

usual. McMurray's patient received a third-degree burn while kneeling on a hot radiator to watch children playing in the street. The parents of the patient described by Boyd and Nie (3) would smell burning flesh and find her leaning casually against a hot stove. The patient of Nissler and Parnitzke (22) allowed a rabbit to nibble off the end of his index finger, and, on another occasion, cut off the end of his tongue and brought it proudly to his mother. The original patient of Dearborn (8) earned his living on the stage as a "Human Pin Cushion" and once attempted to be crucified but, just as he was being nailed to the cross, the exhibition was interrupted by the fainting of a spectator.

Anatomical abnormalities in the nerve endings, nerve trunks, or central nervous system are generally absent. In the few instances of nervous system histologic examination (2, 10, 12, 18, 23), organic lesions are described only in those patients who demonstrated other neurologic deficiencies in addition to insensitivity to pain. Complete examination of the nervous system in an individual solely analgic has not yet been reported, although Biernond (2) did study the brain and upper cervical cord in one of twins with generalized analgia. The patient also had pedal paralysis, was a deaf-mute, and showed a wide spinal canal on x-ray examination. Hypoplasia was found, involving the posterior funiculi, the medial lemniscus, and the ventromedian nucleus of the thalamus; in addition, there was noted some cellular depletion in the post-central gyrus, especially in the region of the parietal operculum. Biernond felt that the anatomical basis in congenital universal indifference to pain thereby was different from that of syringomyelia. Central nervous system syphilis, syringomyelia, etc., have been excluded clinically in reported cases as well as in ours. Hysterical analgesia cannot explain the clinical course. Attempts to elicit pain under hypnosis have been unsuccessful (6). The presence or site of a neurological lesion

to explain this unusual reaction has not been established.

Roentgenologic interest centers about the skeletal lesions, which can be divided into three broad classifications as designated by Fanconi and Ferrazzini: macrotrauma—gross fractures and their sequels; microtrauma—stress fractures and osteochondroses; various forms of osteomyelitis.

Major fractures occur with considerable frequency, usually following adequate trauma. The absence of pain generally suggests pathologic fracture, but careful questioning concerning the forces involved will usually lead away from consideration of any undue fragility of bone. Unaffected skeletal structures show no stigmata of systemic disease, as, for example, osteogenesis imperfecta. Pathologic fractures may occur, but only at the site of previously injured and poorly healed bone, and are actually a sequel to a prior unrecognized injury. Various deformities develop as a result of these fractures and are progressive because trauma is compounded on trauma. The lesions, therefore, are not unlike those in the unrecognized skeletal trauma syndrome of infants (4, 26, 28), where the repetitive nature of the injury results from the custodians' inadequacy in recognizing the trauma. The lesions are also comparable to those occurring in paraplegics, where the lack of pain stems from an organic neurologic lesion (14). Because patients with congenital insensitivity to pain are generally much more active than paraplegics, succeeding trauma is much greater and reparative change is more distorted.

Metaphyseal lesions are extremely common; perhaps they might be classified as sequels to repeated microtrauma, leading to epiphyseal separation, or they might be considered as counterparts, in children, of Charcot joints in adults. Aseptic, necrosis-like lesions were stressed by Fanconi and Ferrazzini as examples of microtrauma.

Inflammatory bone lesions are actually areas of osteomyelitis, usually indolent, and commonly present as a Brodie's

abscess. Multiple recurrences requiring surgical intervention occurred before potent antibiotics became available (19). Biopsies from areas of infection show only chronic osteomyelitis and callous tissue. No particular organism can be said to predominate, possibly because of insufficient bacteriologic studies. It becomes quite clear that the radiologist must be alert to identify this syndrome on the basis of skeletal lesions recognizable as a result of repetitive trauma and/or infection. The clinical information may be totally misleading if the one important lead of insensitivity to pain is not appreciated. During the several surgical procedures undertaken in Case II, routine anesthesia was used and standard premedication was given. One has the impression that these medications were provided more as a medical-surgical ritual than as an actual requirement. Many of the patients described in the literature underwent biopsies, fracture reductions, sternal marrow aspirations, and even major surgery without anesthesia. These were undertaken only after the condition of insensitivity to pain had been appreciated. It is obvious, therefore, that the radiologist cannot rely on his clinical colleagues to tell him in every instance that the lesion he is examining is unassociated with pain; he must ask the question. By his doing so, more individuals with the syndrome of congenital insensitivity to pain will be recognized, and some of the late crippling deformities or early tragedies may be averted.

SUMMARY

Two sisters with congenital insensitivity to pain are described. Medical care was originally sought because of bony deformities which were considered to represent manifestations of "skeletal dystrophy." Retrospective evaluation and clinical testing of one sister, after the syndrome of congenital insensitivity to pain was considered, indicated that the skeletal lesions resulted from repetitive unrecognized trauma to bones. The radio-

graphic appearances are those of injury and repair of bone, occasionally complicated by infection. Associated clinical signs and symptoms in the two patients are described and related to those reported in the literature.

The condition of congenital insensitivity to pain is a poorly understood, probably hereditary condition of variable expressivity which can be suspected on the basis of roentgen studies when skeletal lesions are present. Careful clinical questioning and examinations are required to confirm the diagnosis.

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REFERENCES

1. ARBUSE, D. I., CANTOR, M. B., AND BARENBERG, P. A.: Congenital Indifference to Pain. *J. Pediat.* **35**: 221-226, August 1949.
2. BIEMOND, A.: Investigation of the Brain in a Case of Congenital and Familial Analgesia. *Excerpta Med., Neurol. & Psychiat.* **8**: 885-886, 1955.
3. BOYD, D. A., JR., AND NIE, L. W.: Congenital Universal Indifference to Pain. *Arch. Neurol. & Psychiat.* **61**: 402-412, April 1949.
4. CAFFEY, J.: Some Traumatic Lesions in Growing Bones Other Than Fractures and Dislocations: Clinical and Radiological Features. *Brit. J. Radiol.* **30**: 225-238, May 1957.
5. CERNY-WALDVOGEL, M.: Zur Frage der kongenitalen, generalisierten Schmerzindifferenz (Congenital Universal Indifference to Pain, C. U. I. T. P.) an Hand eines klinischen Falles. *Ann. paediat.* **178**: 65-82, February 1952.
6. COHEN, L. D., KIPNIS, D., KUNKLE, E. C., AND KUBZANSKY, P. E.: Observations of a Person with Congenital Insensitivity to Pain. *J. Abnorm. & Social Psychol.* **51**: 333-338, September 1955.
7. CRITCHLEY, M.: Some Aspects of Pain. *Brit. M. J.* **2**: 891-896, Nov. 17, 1934.
8. DEARBORN, G. V.: A Case of Congenital General Pure Analgesia. *J. Nerv. & Ment. Dis.* **75**: 612-615, June 1932.
9. DURAND, P., AND BELOTTI, B. M.: Un caso di indifferenza congenita al dolore—(algoatarassia); primo contributo della letteratura italiana. *Helvet. paediat. acta* **12**: 116-126, May 1957.
10. FANCONI, G., AND FERRAZZINI, F.: Kongenitale Analgie (kongenitale generalisierte Schmerzindifferenz). *Helvet. paediat. acta* **12**: 79-115, May 1957.
11. FARQUHAR, H. G., AND SUTTON, T.: Congenital Indifference to Pain. *Lancet* **1**: 827-828, April 14, 1951.
12. FEINDEL, W.: Note on the Nerve Endings in a Subject with Arthropathy and Congenital Absence of Pain. *J. Bone & Joint Surg.* **35-B**: 402-407, August 1953.
13. FORD, F. R., AND WILKINS, L.: Congenital Universal Insensitivity to Pain. A Clinical Report of 3 Cases in Children with Discussion of the Literature. *Bull. Johns Hopkins Hosp.* **62**: 448-466, April 1938.
14. GILLIES, C. L., AND HARTUNG, W.: Fracture of the Tibia in Spina Bifida Vera. Report of Two Cases. *Radiology* **31**: 621-623, November 1938.

15. JEWESBURY, E. C. O.: Insensitivity to Pain. *Brain* **74**: 336-353, 1951.
16. KEIZER, D. P. R.: Congenital Indifference to Pain. Letter to Editor. *Lancet* **1**: 1020, 1951.
17. KUNKLE, E. C., AND CHAPMAN, W. P.: Insensitivity to Pain in Man. *Proc. (1942) A. Res. Nerv. & Ment. Dis.* **23**: 100-109, 1943.
18. LAMY, J., GARCIN, R., JAMMET, M. L., AUSSANNAIRE, M., et al.: L'analgésie généralisée congénitale. *Arch. franç. pédiat.* **15**: 433-448, 1958.
19. McMURRAY, G. A.: Experimental Study of a Case of Insensitivity to Pain. *Arch. Neurol. & Psychiat.* **64**: 650-667, November 1950.
20. VON MURALT, G.: Polytope enchondrale Dysostose mit Dysproteinämie und herabgesetzter Osteoblastentätigkeit. *Helvet. paediat. acta* **8**: 295-317, August 1953.
21. MURRAY, R. O.: Congenital Indifference to Pain with Special Reference to Skeletal Changes. *Brit. J. Radiol.* **30**: 2-6, January 1957.
22. NISSLER, K., AND PARNITZKE, K. H.: Fehlen der Schmerzempfindung bei einem Kinde. *Deutsche med. Wchnschr.* **76**: 861-863, June 29, 1951.
23. PETRIE, J. G.: A Case of Progressive Joint Disorders Caused by Insensitivity to Pain. *J. Bone & Joint Surg.* **35-B**: 399-401, August 1953.
24. RILEY, C. M.: Familial Dysautonomia. *Advances in Pediat.* **9**: 157-190, 1957.
25. ROSE, G. K.: Arthropathy of the Ankle in Congenital Indifference to Pain. *J. Bone & Joint Surg.* **35-B**: 408-410, August 1953.
26. SILVERMAN, F. N.: Roentgen Manifestations of Unrecognized Skeletal Trauma in Infants. *Am. J. Roentgenol.* **69**: 413-427, March 1953.
27. WESTLAKE, E. K.: Congenital Indifference to Pain. *Brit. M. J.* **1**: 144, Jan. 19, 1952.
28. WOOLLEY, P. V., JR., AND EVANS, W. A., JR.: Significance of Skeletal Lesions in Infants Resembling Those of Traumatic Origin. *J.A.M.A.* **158**: 539-543, June 18, 1955.

SUMMARIO IN INTERLINGUA

Congenite Insensibilitate A Dolor: Un Syndrome Neurologic Con Bizarre Lesiones Skeletic

Es describe le casos de duo sorores con congenite insensibilitate a dolor, primo vidite per le autores al etates de 12 e 9 annos. Ambas esseva originalmente presentate al consultation medical a causa de deformitates ossee que esseva considerate como manifestationes de "dystrophia skeletic." Le evaluation retrospective e tests clinic in un del casos, post que le possibilitate de un syndrome de congenite insensibilitate a dolor habeva essite prendite in consideration, indicava que le lesiones skeletic esseva le resultado de repetite e non-recognoscite trauma in le ossos. Le apparentias radiographic esseva illos de vulneration e reparo de osso, complicate in certe casos per infectiones. Associate sig-

nos e symptomias clinic in le duo patientes es describe e relationate a illos reportate in le litteratura.

Le lesiones skeletic pote esser dividite in tres classes general: Macrotrauma—i.e. grossier fracturas e lor sequellas; microtrauma—i.e. fracturas de effortio e osteochondroses; e osteomyelitis.

Le condition de congenite insensibilitate a dolor es pauco comprendite. Illo es probabilemente un condition de expressivitate variabile, le presentia de que pote esser suspicite super le base de studios roentgenographic quando lesiones skeletic ha occurrite. Caute questionation e examine clinic es requirite pro confirmar le diagnose.

DISCUSSION

Benjamin Felson, M.D. (Cincinnati, Ohio): I was particularly interested in one of the statements that Dr. Silverman made: "The mother cried from pain when spanking the child." This represents a new twist on the old saw, "This hurts me more than it does you." My own kids seem hypersensitive to pain—they cry before they are hit.

Dr. Silverman's cases may be of greater importance than their apparently rare incidence would indicate. I am intrigued by a possible relationship to certain other bone conditions, including bone erosion under the decubitus ulcers of paraplegics, the Charcot joint, and the icicle-like neurotrophic bone changes seen in leprosy, in diabetes, and beneath trophic soft tissue ulcers.

Dr. Silverman points out that his patients were active after the injury and therefore compounded trauma upon trauma, resulting in greater deformity. He also states that age plays a role and that the metaphyseal changes in children probably represent the counterpart of the Charcot joint in the adult.

Further to tie together these various conditions I would like to refer to two cases reported by Dr. Samuel Goldblatt¹ of Cincinnati. Two sisters

¹ GOLDBLATT, S.: Syndrome of Familial Progressive Sensory Paralysis, Epilepsy, Acral Ulceration, and Bone Destruction in Prepubescent Siblings (Hypovitaminosis B₁₂ Neuropathica). To be published in *Hautarzt*, January 1959.

showed a syndrome consisting of hypotension, epilepsy, generalized lack of sweating, absence of reflexes, loss of peripheral pain sensation and other neurological changes, painless ulcers on the fingers, and, on roentgenograms, Charcot joints and neurotrophic bone changes. Changes in the second sister were much less severe. A third sister showed only a part of the syndrome.

It is of extreme interest that these signs and symptoms were controlled by the administration of vitamin B₁₂ intraspinally and through other routes. The symptoms definitely became worse when the

patients neglected to take the vitamin B₁₂, and when it was deliberately withheld. It is conceivable that there is some hope for the unfortunate children presented by Dr. Silverman through the use of vitamin B₁₂.

I believe, with Hodgson *et al.*, that the so-called neurotrophic bone changes are generally secondary to infection or trophic ulcers, the latter often being the result of trauma. These conclusions seem to be confirmed by the case of Dr. Goldblatt to which I have referred, and by some of the cases of congenital insensitivity to pain in the literature.



Periureteric Fibrosis: Radiographic Diagnosis¹

D. GLYN MILLARD, M.B. B.S.(Lond.), and STANLEY M. WYMAN, M.D.

PERIURETERIC fibrosis, an idiopathic retroperitoneal fibrotic process, is a recently recognized disease characterized by unilateral and bilateral ureteral obstruction. Ormond (1), who first described this condition in 1948, reported 2 cases of bilateral ureteral obstruction. In 1954, Chisholm *et al.* (2) published a case, postulating the etiology and suggesting methods of management. In 1955, Raper (3) reviewed the literature and cited 3 instances in which oliguria developed from bilateral ureteral obstruction. He believed that the disease was of vascular origin. The present report proposes to describe certain clinical and radiographic features observed in 4 cases of periureteric fibrosis studied at the Massachusetts General Hospital. It is hoped that the observations may facilitate the early diagnosis of this rare syndrome.

PATHOLOGY

Periureteric fibrosis is a progressive process involving the retroperitoneal tissues. Raper suggests that it originates in the region of the great vessels, while Chisholm believes that it takes its origin from the fascia of the psoas muscle. It has been found in a case of periarteritis nodosa (4). Trever (5) presented an example in association with reticulum-cell sarcoma and urged extensive search for an etiologic factor. It is known that regional ileitis, appendicitis, and diverticulitis are inflammatory processes capable of producing ureteral obstruction. Chisholm and his associates suggested that in their patients infection in the retroperitoneal space, which encloses the aorta, inferior vena cava, and the urinary tracts, could produce the fibrotic changes. In many of the reported cases, however, evidence of inflammation was absent (6).

Whatever its origin may be, it is known that the fibrotic process extends from the kidneys to the sacral promontory, spreading laterally to involve one or both ureters (1, 2, 3, 7). In one case at the Massachusetts General Hospital, the fibrosis involved the right pelvic ureter, extending medially to the left of the midline over the sacrum and just over the pelvic brim. The ureter embedded in the fibrous tissue was extrinsically narrowed but the ureteral mucosa was intact.

The cut surface of the fibrotic lesion is grayish-white, its appearance being similar to that of metastatic carcinoma or lymphoma (8). Microscopically the process shows an actively sclerosing type of inflammatory fibrosis infiltrated with monocytes, lymphocytes, and some eosinophils. Culture for organisms is negative.

Amselem (9) commented that the retroperitoneal cicatrix may be due to surgical trauma and the presence of suture material. It is interesting that in one of Ormond's cases, in MacLean's (10) case, and in the 4 here presented there had been previous abdominal surgery, but it is difficult to determine whether surgical trauma bears any causative relationship to the fibrotic process, whose etiology is unknown.

CLINICAL FEATURES

A good history is usually the key to the diagnosis of any disease. Periureteric fibrosis is no exception. Pain, initially vague in character, is the chief presenting symptom. It has been described as an indefinite backache, a gnawing feeling, or a dragging discomfort in the lower quadrants of the abdomen, changing later to a cramp-like pain radiating into the genitalia or thighs. The pain becomes worse on lying down. It is sometimes

¹ From the Department of Radiology, Massachusetts General Hospital, Boston, Mass. Accepted for publication in May 1958.

TABLE 1: TEN CASES OF PERIURETERIC FIBROSIS

Case No.	Presenting Symptoms and Temperature	Sex and Age	Abdominal Examination	Laboratory Data	Radiographic Findings	Previous Abdominal Surgery
1 (Millard and Wyman) (A)	Dull midabdominal pain with periods of severe cramps. Improved on sitting up or doubling over. T. 98.4	M56	No masses or costovertebral angle tenderness.	Urine: Occasional RBC and WBC. WBC 12,500 Normal differential NPN 27 mg. %	<i>IVP</i> : Hydroureter of major and minor calyces and left pelvis. <i>Retrograde</i> : Hydroureter to level L-4, where it ends in tapering fashion.	Subtotal gastrectomy. Herniorrhaphy. Drainage of left empyema.
2 (Millard and Wyman) (B)	Persistent aching RLQ pain, with radiation along right ureter. T. 98.4	M38	No masses or costovertebral angle tenderness.	Urine: 0-2 RBC and WBC. WBC 8,800 Normal differential NPN 31 mg. %	<i>IVP</i> : Diminished function. <i>Retrograde</i> : Area of cone-like narrowing in lower third of right ureter at level of upper border of sacrum. Typical tapering and narrowing. Catheter passed through narrowing.	Abdominal aspiration on left side for abscess at age 5 years.
3 (Millard and Wyman)	Soreness with vague, poorly defined pains in both lower quadrants.	M64	No masses or costovertebral angle tenderness.	Urine: Albumin +, 50 crenated RBC. WBC 9,700 Normal differential NPN 80 mg. %	<i>IVP</i> : Delayed excretion. Hydroureter of major and minor calyces and dilatation of ureter to level of sacrum. <i>Retrograde</i> : Bilateral hydroureter.	Appendectomy. Herniorrhaphy.
4 (Millard and Wyman) (C)	Vague RLQ discomfort, later noted in right midportion of back and still later associated with burning discomfort in right testis. Subsequently severe pain in lumbar region. T. 98.4	M59	No masses. Moderate right costovertebral angle tenderness over lower pole, right kidney.	Urine: 10-40 WBC rare RBC. WBC 13,900 Normal differential NPN 32 mg. %	<i>IVP</i> : Delayed excretion. Hydroureter present with obstruction at transverse process of L-5 on right. Best film in 210 minutes. <i>Retrograde</i> : Hydroureter on right. Extent of obstruction not seen.	Cholecystectomy.
5 (Ormond)	Low backache and pain radiating down both thighs, especially left.	M45	None.	Urine: Occasional WBC. WBC 5,800 Normal differential BUN 110 mg. %	<i>Retrograde</i> : Catheters can be passed up ureters.	None.
6 (Ormond)	Lumbosacral pain, later with ache in testis.	M43	None.	Urine: Negative. WBC 8,250	<i>Retrograde</i> : Catheters passed up both ureters. Dilatation of left pelvis.	Cholecystectomy. Appendectomy.
7 (Raper)	Abdominal colic.	F25	Tender enlarged left kidney and slight tenderness, right loin.	Urine: Few RBC and WBC. WBC not known BUN 240 mg. %	Catheters passed into both ureters. Pyelograms showed right hydroureter with a tortuous upper ureter.	No history.
8 (Raper)	Severe pain in left loin.	M45	None.	Urine: Frequent WBC WBC 16,000 BUN 560 mg. %; later, 172 mg. %	Ascending pyelograms showed both ureters held up at 10 cm.	No history.

TABLE I—Continued

Case No.	Presenting Symptoms and Temperature	Sex and Age	Abdominal Examination	Laboratory Data	Radiographic Findings	Previous Abdominal Surgery
9 (Raper)	Slight pain in left loin. Also complaint of painful lower abdominal distention and constipation.	F41	None.	Urine: No report. Anuric WBC and NPN not reported.	Ureteral catheters passed up both ureters; on right, catheter was obstructed at pelviureteral junction. <i>Retrograde:</i> Showed right hydronephrosis with slight left hydronephrosis.	Recent total hysterectomy. Bilateral salpingo-oophorectomy.
10 (MacLean) (D)	Pain in sacral region and both hips; later pain in left loin, dull and steady in character, not colicky. No radiation. T 99.	M24	Tender in left costophrenic angle and along course of ureter.	Urine: 20 RBC, trace WBC.	<i>IVP:</i> Considerable hydronephrosis on left side with filling defect in lower ureter. <i>Retrograde:</i> Impossible to get catheter up the ureter beyond first few inches. Medium stopped in sacral region.	Appendectomy at age 9 years.



Fig. 1. Delayed excretion with hydronephrosis and hydroureter during intravenous urography, 210 minutes after the injection of the contrast substance. The obstruction begins at the inferior border of the right transverse process of the fifth lumbar vertebra.

relieved by lying prone or in the "doubled-over" position as described by one patient. Usually slight abnormalities in the urine, occasional red and white blood cells, and slight elevation of the white blood cell count were the only laboratory changes noted. Fever is absent. The patients with anuria present with various signs and symptoms of uremia, with abnormalities in the urine and elevation of the serum non-protein nitrogen or urea nitrogen. It is seen in Table I that the physical signs and laboratory tests are unremarkable; nevertheless, they contribute something by their very normality. This is particularly evident in cases of

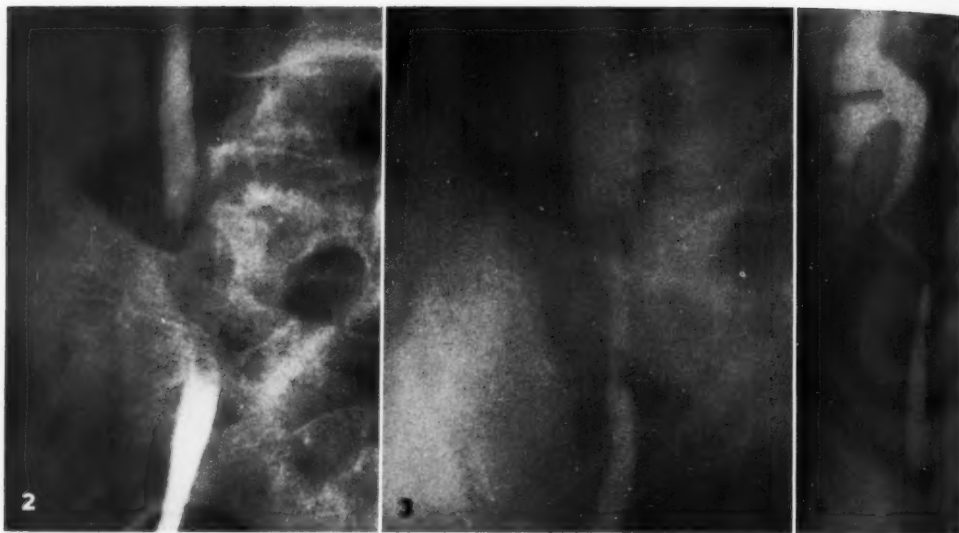


Fig. 2. Localized narrowing of the ureter extending 4 cm. distally from the inferior border of the right transverse process of the fifth lumbar vertebra.

Fig. 3. Hydroureter ending in a smooth cone-like narrowing, tapering gradually into an irregular isthmus.

Fig. 4. Hydronephrosis and hydroureter with medial deviation of the ureter demonstrated during retrograde urography.

unilateral obstruction (Cases A, B, C, and D).

RADIOGRAPHIC FINDINGS

Plain films of the abdomen, the first step in a radiologic examination, may show disappearance of the normal fat lines which outline the various retroperitoneal structures, notably the psoas and lumbosacral muscle (11). This absence of fat planes may assist in identifying a mass of inflammatory tissue obscuring these retroperitoneal structures.

Intravenous urography is the prime radiographic procedure which demonstrates the abnormality in the urinary tracts. There may be delayed excretion of the contrast material (Fig. 1), dilatation of the major and minor calyces and/or the kidney pelvis, or complete urinary obstruction on one or both sides. If the obstruction is apparent, the contrast material gradually tapers, demonstrating a local narrowing of the ureter (Figs. 2 and 3). The actual cause of the obstruction may not be evident. This may best be demonstrated by retrograde urography. Despite the

degree of obstruction, a catheter may be passed beyond the point of narrowing, sometimes with remarkable ease (1, 9, 12). This is not always possible, however. Insertion of the catheter to the point of obstruction and injection of the opaque substance may be the most definitive diagnostic procedure. The ureter above the point of obstruction is dilated, the dilatation ending in a smooth cone-like narrowing, tapering gradually into an irregular isthmus, which is fixed in position and whose diameter does not vary (Figs. 3 and 4). The narrowed segment may be 3-4 cm. in length (Figs. 2 and 3).

DISCUSSION

The early recognition and diagnosis of ureteral obstruction caused by periureteric fibrosis are most important for surgical relief of the obstruction produced by the insidious creeping of the fibrotic process which may eventually involve both ureters and thereby produce anuria. Retroperitoneal air insufflation (16) may supplement the urographic studies in establishing the presence of retroperitoneal disease.

Observation of the peristaltic activity of the ureters by means of fluorography or cinefluorography may contribute to our knowledge of the pathologic physiology of the involved segment of ureter and help explain the apparently paradoxical ease of retrograde catheterization.

The absence of a mechanical obstruction to the passage of a ureteral catheter in the presence of anuria suggests the possibility of retroperitoneal malignant infiltration (6). To distinguish this from periureteric fibrosis is difficult if not impossible. A nonopaque ureteral calculus or blood clot can produce ureteral obstruction and substantially the same roentgenographic findings. Beahrs *et al.* (13) reported asymptomatic ureteral obstruction caused by an intramural endometrial implant, and it is seen that their radiographic findings were similar to those of periureteric fibrosis. Primary carcinoma of the ureter causing ureteral obstruction has been well documented (14) and can be distinguished from periureteric fibrosis.

Various procedures have been used to alleviate the symptoms and signs of ureteral obstruction. Antibiotics, with indwelling catheters, which were later removed from the ureter engulfed in the fibrotic process, have been used with success (7). Other methods of treatment include ureterolysis (2) and placing the ureter free in the abdominal cavity (1), bilateral nephrostomies with ureteral dilatation (1), nephrectomy (8) and radiation therapy (1, 15). Ureterolysis is probably the treatment of choice.

The only report of a death due to this disease was in Ormond's original paper. The kidneys had been completely destroyed by infection and back pressure caused by envelopment and compression of the ureters by the fibrotic process.

SUMMARY

This brief report presents the clinical and radiographic findings of 4 known cases of periureteric fibrosis. Clinically the chief presenting symptom is a vague,

indefinite backache or dragging discomfort in the lower quadrants of the abdomen, changing later to a cramp-like pain radiating into the genitalia or thighs. The pain is relieved in the prone position or with the lumbar spine flexed. Urinalysis and hematological studies reveal minimal changes, and there is no fever.

Radiographically intravenous and retrograde urography reveal delayed excretion and hydronephrosis. Ureteral narrowing extending 3-4 cm., with a fixed diameter of 2-3 mm. and gradually tapering ends, is demonstrated. Ureteral catheters can be passed, sometimes beyond the point of narrowing.

Periureteric fibrosis must be distinguished from retroperitoneal malignant infiltration, nonopaque calculus, blood clot in the ureter, and a ureteral intramural endometrial implant. The diagnosis may be suggested by the radiologist from the history and the radiographic signs.

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REFERENCES

1. ORMOND, J. K.: Bilateral Ureteral Obstruction Due to Envelopment and Compression by Inflammatory Retroperitoneal Process. *J. Urol.* **59**: 1072-1079, June 1948.
2. CHISHOLM, E. R., HUTCH, J. A., AND BOLOMEY, A. A.: Bilateral Ureteral Obstruction Due to Chronic Inflammation of Fascia Around Ureters. *J. Urol.* **72**: 812-816, November 1954.
3. RAPER, F. P.: Bilateral Symmetrical Periureteric Fibrosis. *Proc. Roy. Soc. Med.* **48**: 736-740, September 1955.
4. KERR, W.: Personal communication.
5. TREVER, R. W.: Reticulum-Cell Sarcoma Producing Retroperitoneal and Periureteric Fibrosis. Report of a Case. *New England J. Med.* **258**: 268-270, Jan. 30, 1958.
6. Periureteric Fibrosis. Editorial. *Lancet* **2**: 780, 1957.
7. MILLER, J. M., LIPIN, R. J., MEISEL, H. J., AND LONG, P. H.: Bilateral Ureteral Obstruction Due to Compression by Chronic Retroperitoneal Inflammation. *J. Urol.* **68**: 447-451, August 1952.
8. Case records of the Massachusetts General Hospital; Case 44101. *New England J. Med.* **258**: 493-498, March 6, 1958.
9. AMSELEM, A.: Hidronefrosis bilateral gigante sin obstáculo orgánico aparente (pseudosclerosis renal). *Med. españ.* **23**: 230-235, March 1950.
10. MACLEAN, J. T.: Unusual Conditions of Ureter and Kidney. *Brit. J. Urol.* **26**: 127-138, June 1954.
11. HOLMES, G. W., AND ROBBINS, L. L.: Roentgen Interpretation. Philadelphia, Lea & Febiger, 8th ed., 1955, p. 372.

12. EWELL, G. H., AND BRUSKEWITZ, H. W.: Bilateral Ureteral Obstruction Due to Envelopment and Compression by Inflammatory Retroperitoneal Process. *Urol. & Cutan. Rev.* **56**: 3-10, January 1952.
13. BEAHRS, O. H., HUNTER, J. S., JR., AND SLOSS, P. T.: Intramural, Obstructing Endometriosis of the Ureter. *Proc. Staff Meet. Mayo Clin.* **32**: 73-77, February 1957.
14. HOLMES, R. B.: Primary Tumors of the Ureter: Their Roentgen Diagnostic Features. *Radiology* **56**: 520-527, April 1951.
15. OPPENHEIMER, G. D., NARINS, L., AND SIMON, N.: Radiotherapy in Nonspecific Inflammatory Stricture of Ureter. *J. Urol.* **67**: 476-478, April 1952.
16. LANDES, R. R., AND RANSOM, C. L.: Technique for the Use of Carbon Dioxide in Presacral Retroperitoneal Pneumography. *Surg., Gynec. & Obst.* **105**: 268-272, September 1957.

SUMMARIO IN INTERLINGUA

Fibrose Periureteral: Diagnose Radiographic

Iste breve reporto presenta le constata-tiones clinic e radiographic de 4 cognoscite casos de fibrosis periureteral. Ab le puncto de vista clinic, le principal symp-toma de presentation es un vage typo de dorsalgia o de disconforto pesante in le quadrantes inferior del abdomine, con transition subsequente in spasmodic dolores radiante a in le genitales o le femores. Le dolor es alleviate in decubito ventral o con flexion del spina lumbar. Le analyse del urina e studios hematologic revela solmente alterationes minimal, e nulle febre es presente.

Ab le puncto de vista radiographic, uro-

graphia intravenose e retrograde revela retardo de excretion e hydronephrose. Stricture ureteral, a un distantia de 3 a 4 cm, con un diametro fixe de 2 a 3 mm e re-expansion gradual in ambe directiones, es demonstrate. Catheteres ureteral pote es-ser inserite, a vices in ultra del puncto del strictura.

Fibrose periureteral debe esser distin-guite ab maligne infiltration retroperito-neal, calculo non-opac, coagulo de sanguine in le ureter, e un implanta endometrial in-tramural ureteral. Le diagnose pote esser suggerite per le radiologo super le base del historia e del signos radiographic.



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The Normal Lateral Pneumotomographic Appearance of the Pancreas¹

HANS LUDIN, M.D.,² and THANE ASCH, M.D.

IF WE REVIEW the major unsolved problems in clinical diagnostic radiology, our attention is immediately attracted to the parenchymatous organs of the upper abdomen. The need to examine these organs radiographically is challenging, since diagnostic problems involving the epigastrium are frequent. Because of the deep location of the pancreas and its relatively small dimensions, significant changes in size and shape of the gland may not be noted by palpation or by routine radiographic methods. Indirect radiographic signs, such as displacement of adjacent organs, are present only if the pancreatic enlargement is considerable and may be absent or questionable even in massive lesions. Frequently, therefore, with disease of the pancreas or biliary tree, a conclusive evaluation is obtained only after operation. Since many of these conditions are surgical, a definitive clinical diagnosis is often not very important, and a radiological diagnosis would be desirable only if the procedure were safe, conclusive, relatively simple, and with well defined limitations. In a minority of cases, however an evaluation of the pancreas without resort to laparotomy is desirable.

There are two practical methods for visualizing a parenchymatous organ possessing an excretory system. One method strives for a delineation of the gross appearance of the organ. A second method utilizes opacification of the excretory system to demonstrate the internal architecture. This latter approach has been successfully accomplished following insertion of a T-tube at the time of operation by Doubilet and his group (1). A more useful method for demonstration of the secretory system of an organ employs parenchymal

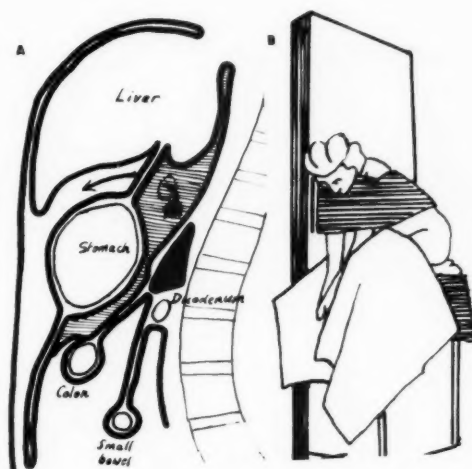


Fig. 1A. Schematic lateral view of the epigastrium midsagittal plane. (Pancreas in black).

Fig. 1B. Position of the patient with respect to the tomography table.

saturation with a contrast substance, as in nephrography or nephrotomography. As yet, no such substance which fulfills the pharmacological requirements has been found for the pancreas. There is little doubt that this would be the ideal method! Because of the peculiar vascular distribution and the small circulation of the pancreas, angiographic methods do not seem to be promising.

There remains the introduction of gas as a contrast agent. The simplest procedure of this type is evaluation of the width of the retrogastric space by inflation of the stomach according to Engel and Lysholm (2). Kuhlmann (3), Ludin (4), Bonomini (5), Macarini and Oliva (6, 9), Sansone *et al.* (7), and Lura (8), have used retroperitoneal insufflation combined with gastric insufflation or pneumoperitoneum, with tomography in different planes.

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² James Picker Fellow in Radiology.

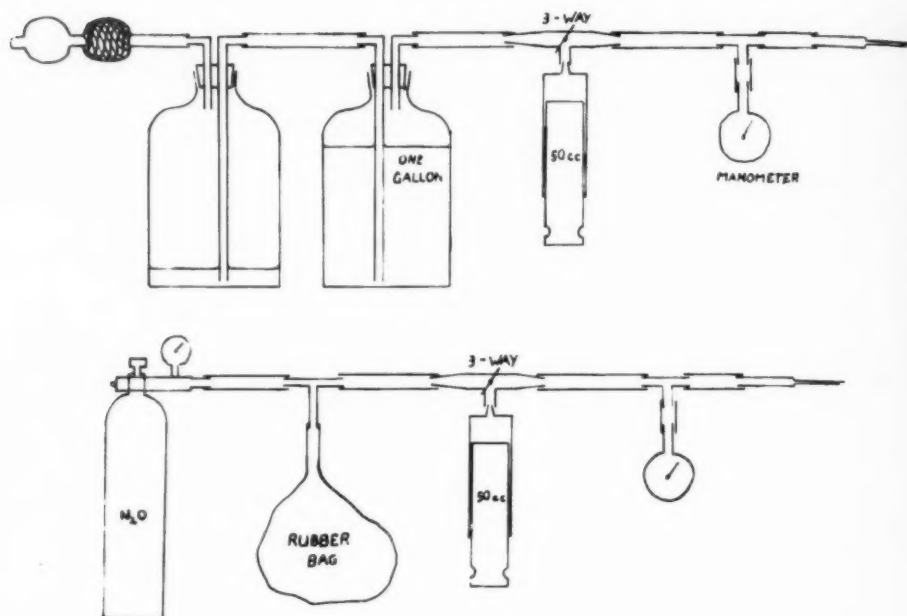


Fig. 2. Schematic drawing of two insufflation devices utilizing (upper scheme) a bottle system analogous to a pneumoperitoneum apparatus and (lower scheme) a rubber bag directly connected to the nitrous oxide bottle.

TECHNIC

Our technic is based on the anatomical knowledge that the pancreas is bounded posteriorly by the retroperitoneal fat tissues, anteriorly by the omental bursa, and below by the inframesocolic peritoneal cavity and its intestinal contents (Fig. 1A). Inflation of the retroperitoneal space as well as the peritoneal cavity, especially the omental bursa, will provide the contrast necessary to delineate the anterior and posterior walls of the pancreas. Lateral tomographic sections taken after insufflation will then show the pancreas in cross section.

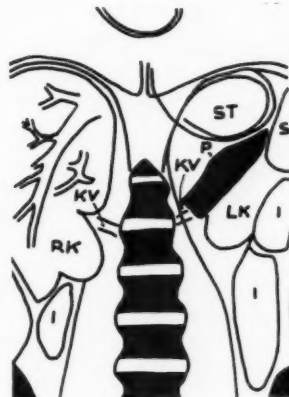
Most authors recommend air or oxygen as a contrast agent. It has been shown recently, however, that retroperitoneal insufflation with these gases has a definite morbidity and mortality, due mainly to embolism. Carbon dioxide, on the other hand, has been injected intravenously to demonstrate the thickness of heart chamber walls. The danger of gas embolism can be reduced to a minimum by the use of nitrous oxide as suggested by Teschen-

dorf (10). The speed of absorption is so great that the discomfort experienced by the patient disappears within an hour or so and he may be ambulatory a few hours after the examination is completed. This rapid absorption necessitates very speedy work. Aside from the possibility of gas embolism there is very little danger with this examination. There was no evidence of embolization in our series, comprising 26 examinations, nor was pneumomediastinum observed in any instance. Many patients tolerate the procedure with only minor complaints; others experience some discomfort, especially when the gas permeates the retroperitoneal space.

A diagram of the apparatus used for the introduction of nitrous oxide is shown in Figure 2. It works according to the principle of a pneumothorax insufflating device. About 800 to 1,000 c.c. of gas is introduced into the peritoneal cavity after the insertion, under local anesthesia, of a blunt needle with a lateral outlet. If the tip of the needle is in good position, the pressure reading on the manometer will



D. Duodenum
HV. Hepatic veins
I. Intestine
L. Liver
P. Pancreas
ST. Stomach
VP. Portal vein



I. Intestine
KV. Renal vessels
LK. Left kidney
P. Pancreas
RK. Right kidney
S. Spleen
ST. Stomach

Fig. 3. Radiographs of frontal frozen sections showing the topographic anatomy of the pancreas (cuts are from anterior to posterior).

be low (below 50 mm. Hg), and the gas may be introduced rapidly. The patient is then turned on his right side with his knees pulled up. Another needle, with a sharp tip, is introduced into the perineum midway between the anus and the tip of the coccyx in the midsagittal plane, under local anesthesia. The course of the needle is guided by the index finger, which is placed in the rectum. When the ano-coccygeal ligament has been perforated, the syringe is lowered, so that the needle is now in a tangential plane with respect

to the rectal wall. The finger remains in the rectum for continued control of the needle tip. About 800 to 1,200 c.c. of gas is introduced in a few minutes, whereupon the patient is slowly turned into prone position and then on the other side, the needle lying in place. An equal amount of gas is again injected under digital control. A portion of the gas is absorbed even during the injection. The patient is then placed in a sitting position, leaning forward, with his side toward a vertical tomography table (Fig. 1B). This enables the stomach

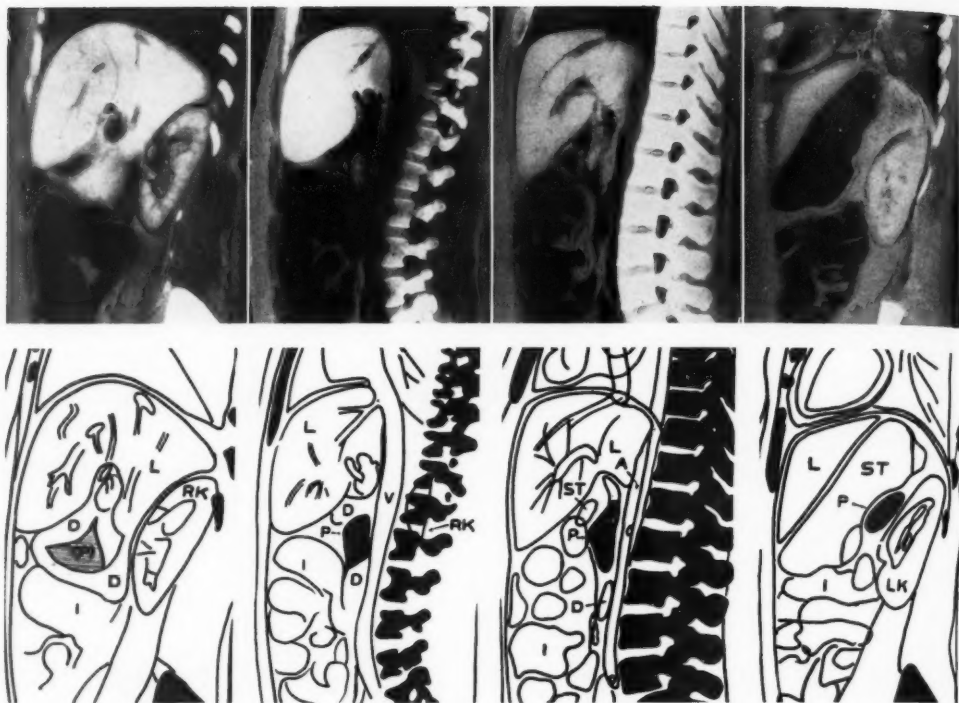


Fig. 4. Radiographs of sagittal frozen sections showing the topographic anatomy of the pancreas (cuts are from right to left). A. Aorta, D. Duodenum, I. Intestine, L. Liver, P. Pancreas, ST. Stomach, LK. Left kidney, RK. Right kidney, V. Inferior vena cava.

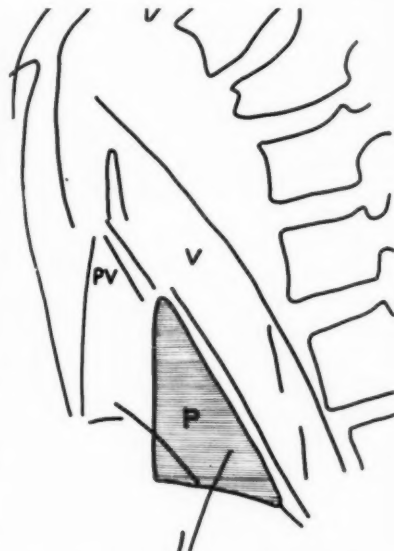


Fig. 5. Experimental pneumotomogram obtained on a fresh necropsy specimen. The pancreas has been injected directly with 90 per cent Hypaque and appears opacified in cross section in front of the portal vein. (The latter structure is irregularly opacified.) P. Pancreas, PV. Portal vein, V. Inferior vena cava.

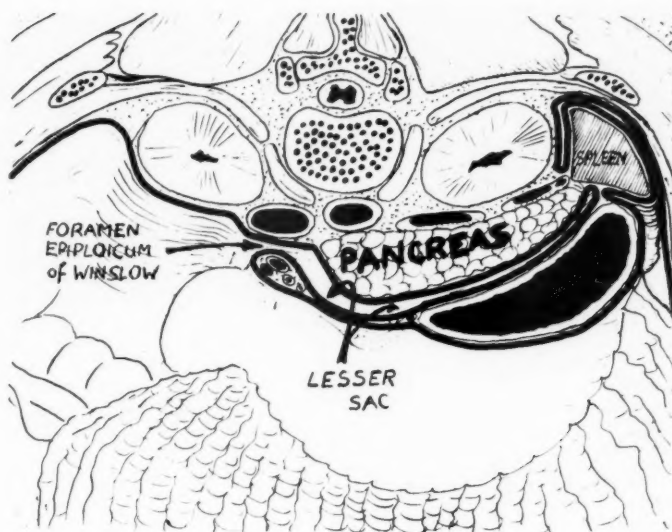


Fig. 6. Pancreas and surrounding organs seen from above and in front showing its relation to the omental bursa, the kidneys, the hepatic pedicle, inferior vena cava, aorta, spleen, splenic vessels, and stomach.

to fall forward and the omental bursa to open. Sometimes it is useful to inflate the stomach by an effervescent mixture. Films are taken at the level of the pancreas at 1- or 2-cm. intervals. A multiple film cassette cuts down radiation considerably. An anteroposterior abdominal film is taken for control and orientation.

NORMAL ANATOMY

For clarification of the somewhat unfamiliar anatomical relations of the pancreas in this projection, radiographs of frontal (Fig. 3) and sagittal (Fig. 4) frozen sections of a cadaver proved useful.

Furthermore, a special examination was carried out on a cadaver. After pneumotomography a few c.c. of Hypaque 90 per cent were injected diffusely into the pancreatic substance, the abdomen was closed, and some supplementary gas was injected into the peritoneal cavity and the retroperitoneal space. A roentgenogram (Fig. 5) of the precaval region confirms the fact that the structure delineated on both sides (posteriorly by retroperitoneal gas insufflation and anteriorly by omental bursal gas) is actually the pancreas. The

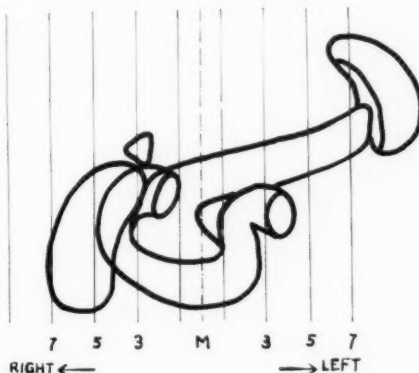
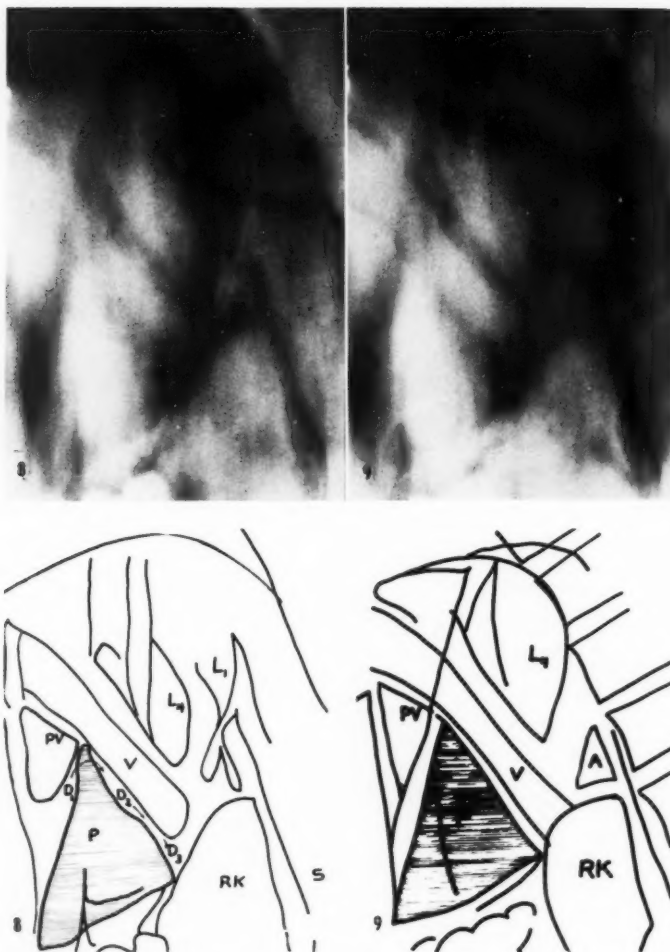


Fig. 7. Schematic frontal view of the pancreas showing the tomographic planes depicted in Figures 8-12 with respect to the midsagittal plane.

pancreatic gland appears thicker in the living subject than in the postmortem specimen, because it has a tendency to stretch following removal. A certain projectional magnification must also be considered. An attempt was made to fill the inferior vena cava and portal vein. Unfortunately, this resulted in blurring of the pancreatic shadow.

A thorough knowledge of the anatomy

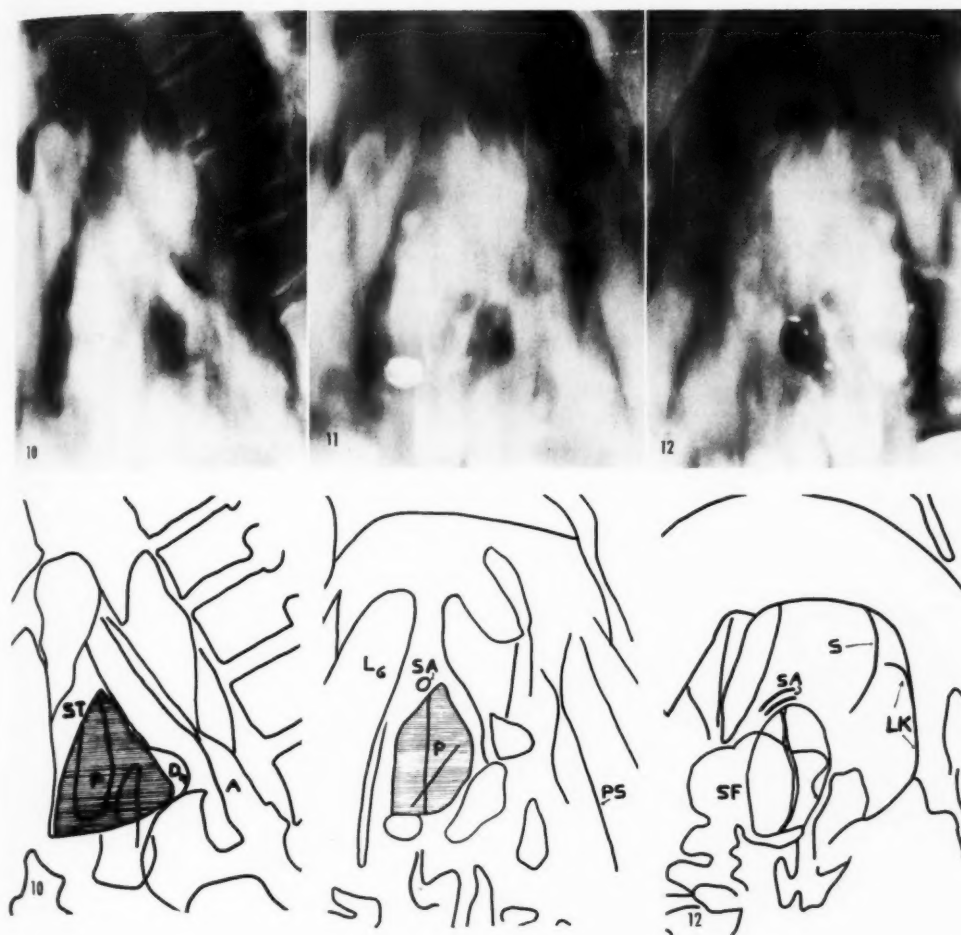


Figs. 8 and 9. Lateral pneumatographic views of the pancreas 5 and 3 cm. to the right of the midsagittal plane, respectively. See also Figures 10-12. A. Right adrenal gland. D. Duodenum, first, second, and third portions. L₁. Posterior portion of right lobe of liver. L₂. Posteromedial portion of right lobe of liver. P. Pancreas. PV. Portal vein near porta hepatis, running obliquely. RK. Right kidney. S. Lumbar spine. V. Inferior vena cava.

of the epigastrium, as well as some experience, is necessary to interpret correctly the roentgenograms obtained. The relations of the pancreas to the spine, the great vessels, kidneys, adrenals, spleen, liver, stomach, portal vein, and the peritoneal ligaments constitute the basis of the radiologic interpretation (Fig. 6). The position of the pancreatic head with respect to the inferior vena cava is especially helpful in an attempt to locate the head exactly. The constitutional vari-

ations of the size of the pancreas, especially its thickness, and of the position of the tail, are remarkable.

The normal pancreas has a certain characteristic appearance on the lateral tomographic sections: First, the cross section of the gland presents as a triangle with straight or minimally bulging walls. In our experience, a real bulging of the normally straight walls indicates an expansive process within the gland. In the region of the body, the pancreatic cross



Figs. 10-12. Lateral pneumatographic views of the pancreas 3 cm., 5 cm., and 7 cm. to the left of the midsagittal plane, respectively. A. Aorta. D₄. Duodenum. L₆. Left lobe of liver. LK. Left kidney. P. Pancreas. PS. Anterior psoas margin. S. Spleen. SA. Splenic artery. SF. Splenic flexure of colon. ST. Stomach.

section is more slender than in the head; it may even be somewhat ovoid in the neck region. The cross section of the tail is usually triangular (Figs. 7-12).

The dimensions of the pancreas given by Poppel (12) apparently do not take into account projectional magnification, which depends on the tomographic technique used.

LIMITATIONS OF THE METHOD

As stated above, the procedure in our experience does not involve any serious risks. The discomfort experienced by the

patients does not exceed the feeling of tension caused by a retroperitoneal insufflation. The radiation hazard does not appear to be of any importance, especially when multifilm cassettes are used; furthermore, most of the patients with diagnostic problems involving the pancreas are in the older age group.

Certain limitations are imposed more frequently by this method than in pneumotomographic visualization of the adrenals, due to unsatisfactory distribution of the injected gas. As in many other radiographic procedures, the difficulties prove

to be greater in obese patients. Apart from this, the permeability of the retroperitoneal space to gas varies considerably from patient to patient. Any acute or chronic inflammatory condition, former radiotherapy, etc., can interfere with gas perfusion in this space. Pancreatitis and peripancreatic inflammation, as well as fat necrosis of the pancreas, result in blurring of the pancreatic outlines. Furthermore, adequate gas filling of the omental bursa does not invariably occur. This appears to be dependent on the general body habitus of the patient and on local conditions involving the foramen of Winslow.

CONCLUSIONS AND SUMMARY

In many cases the pneumotomographic method described above leads to a satisfactory visualization of the pancreas. Only technically adequate roentgen studies should be interpreted. The method proves useful, in selected cases, in the elucidation of diagnostic problems involving the epigastrium.

ACKNOWLEDGMENT: We wish to express our gratitude to the James Picker Foundation for financial support.

REFERENCES

1. DOUBILET, H., POPPEL, M. H., AND MULHOLLAND, J. H.: Pancreatography: Technics, Principles, and Observations. *Radiology* **64**: 325-339, March 1955.
2. ENGEL, A., AND LYSHOLM, E.: A New Roentgenological Method of Pancreas Examination and Its Practical Results. *Acta radiol.* **15**: 635-651, 1934.
3. KUHLMANN, F.: Die Röntgenuntersuchung des Pankreas. *Fortschr. a. d. Geb. d. Röntgenstrahlen* **57**: 629-639, June 1938.
4. LUDIN, M.: Röntgenbefunde bei Pankreaserkrankungen. *Gastroenterologica* **78**: 93-123, 1952.
5. BONOMINI, B.: Duodeno, pancreas, peduncolo epatico, studiati con l'associazione stratigrafia e pneumoretroperitoneo. *Ann. radiol. diag.* **25**: 73-88, 1952-1953.
6. MACARINI, N., AND OLIVA, L.: La dimostrazione radiologica diretta del pancreas. *Radiol. med.* **37**: 961-969, December 1951.
7. SANSONE, G., MACARINI, N., AND OLIVA, L.: La visualizzazione del pancreas nel bambino per mezzo stratigrafia e della insufflazione retroperitoneale. *Minerva pediat.* **3**: 343-358, June 1951.
8. LURA, A.: La stratigrafia associata ai mezzi di contrasto gassosi nello studio degli organi addominali. *Arch. ital. mal. app. diger.* **17**: 3-30, 1951.
9. MACARINI, N., AND OLIVA, L.: Neue Wege zur Pankreasdarstellung. *Fortschr. a. d. Geb. d. Röntgenstrahlen* **86**: 55-65, January 1957.
10. TESCHENDORF, W.: Über die Verwendung schnell resorbierbarer Gase in der Röntgendiagnostik. *Acta radiol.* **36**: 297-304, October 1951.
11. LUDIN, H.: Kombinierte Pankreaspneumographie. *Schweiz. med. Wchnschr.* **85**: 55-61, Jan. 15, 1955.
12. POPPEL, M. H.: Roentgen Manifestations of Pancreatic Disease. Springfield, Ill., Charles C Thomas, 1951.

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SUMMARIO IN INTERLINGUA

Le Apparentia Normal Del Pancreas In Pneumotomographia Lateral

Es describe un methodo de insufflation retroperitonee con oxydo nitrose, pro le obtention de roentgenogrammas tomographic del pancreas.

In sectiones tomographic lateral, le section transverse del glandula se presenta in le forma de un triangulo con parietes recte o minimalmente extruse. In le experientia del autor, un ver extrusion del parietes indica un processo expansive intra le glandula. In le region del corpore, le section transverse del pancreas es plus delicate que in le capite, e in le region cervical illo mesmo pote esser plus o minus ovoide. Le section transverse del cauda es usualmente triangular.

Le limitation principal de iste methodo de pancreatographia es le occurrentia sporadic de un distribution nonsatisfactori del gas que on ha injicite. Isto vale specialmente in le caso de individuos obese. Le adequate plenation del bursa omental con gas non se effectua invariabilemente. Le permeabilitate del spatio retroperitonee a gas varia considerabilemente ab un patiente al altere. Un acute o chronic condition inflammatori, per exemplo del genere resultante de previe radiotherapia, de pancreatitis, o de peripancreatitis, pote obstruer le perfusion de gas, e necrosis grasse del pancreas pote resultar in le obfuscation del contornos pancreatic.

Diagnostic Artificial Pneumoperitoneum

NESTOR R. CANOY, M.D.

THE ARTIFICIAL introduction of air into the peritoneal cavity as an important part of the medical management of tuberculosis is widely known. The use of this procedure as a vital diagnostic tool, however, is less familiar. We are convinced that it is unexcelled for the diagnosis of upper intra-abdominal masses outside of the stomach and intestines, especially if it is combined with a contrast study of the gastrointestinal tract. The procedure is simple and innocuous and devoid of any unpleasant sequelae, since the amount of air introduced is much less than is ordinarily employed in therapeutic artificial pneumoperitoneum. It is thus handy and convenient, as it can easily be performed on an outpatient basis.

Our technic consists simply in the introduction of a 22-gauge needle by a right or left para-umbilical route, the same needle being used for local anesthesia and for penetrating the peritoneal cavity. If the patient is obese, a 22-gauge spinal needle is used following local anesthesia. To determine the position of the needle, an aspiration test is done. If no air is aspirated, the needle is either within the peritoneal cavity or in the anterior abdominal wall. If air is aspirated, the needle has penetrated the intestine. Usually, during the puncture one gets a sensation of giving way as the needle is pushed deeper. This indicates that the tip of the needle has penetrated the peritoneum into the abdominal cavity. As a further test, 30 c.c. of air is introduced with a 50-c.c. syringe. If the tip of the needle lies within the peritoneal cavity, no resistance is encountered as the plunger of the syringe is pushed in. After the needle is in place, from 300 to 500 c.c. of air, depending on the size of the patient, is introduced with the aid of a 50-c.c. syringe and a three-

way stopcock. The needle is withdrawn and the patient is placed in a prone position for five minutes, with the table tilted upward about 30°. Postero-anterior, right and left anterior oblique, and upright films of the abdomen are then taken. If the lesion in question is close to the diaphragm, upright chest films are obtained in various projections. Whenever the mass protrudes anteriorly, a translateral film of the abdomen with the patient supine is taken, with a fine grid.

ILLUSTRATIVE CASES

CASE I: A 48-year-old Chinese salesman was admitted to the hospital complaining of jaundice and general body weakness. His present illness dated back six months, when he first experienced vague upper abdominal discomfort and impairment of appetite associated with a slowly progressive weight loss. At the time of admission he had lost approximately 20 pounds. Four months after the onset, he noticed that he was becoming pale and slightly yellow, the yellowish tinge being especially prominent in his eyes. At the same time, he began to have some ill-defined intermittent pain in the upper abdomen, sometimes localized on the right and occasionally radiating to the back. On admission, the jaundice was very pronounced.

The past history was noncontributory except that the patient resided in an area where schistosomiasis was endemic, though he denied ever having had symptoms of that disease before the onset of the present illness.

Aside from the emaciation, the marked jaundice, and the pale conjunctivae, there was nothing significant in the physical examination. The liver was not palpable and no abnormal masses could be appreciated in the abdomen. There was no definite area of tenderness except that, on deep palpation below the right costal margin, the patient complained of vague pain during deep inspiration. The abdomen was not distended and there was no evidence of fluid within.

The laboratory findings were: red cell count 3,250,000, hemoglobin 9.3 gm., white cell count and differential count normal, icterus index 129, a positive direct Van den Bergh test, and 3 plus urobilin in the urine. Blood urea nitrogen determination, routine urinalysis, and repeated stool examina-

¹ From the Department of Radiology and Nuclear Medicine, Chong Hua Hospital, and the College of Medicine, Southwestern Colleges, Cebu City, P. I. Accepted for publication in May 1958.

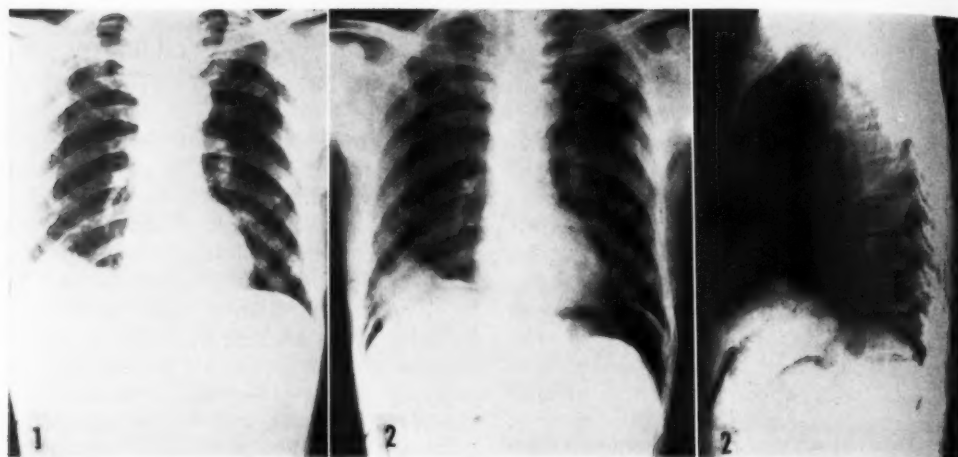


Fig. 1. Case I. Postero-anterior chest film before the introduction of air. Note the lobulation of the right leaf of the diaphragm.

Fig. 2. Case I. Postero-anterior and right lateral films of the chest after the introduction of 300 c.c. of air into the peritoneal cavity. A fairly large mass arising from the superior surface of the right lobe of the liver is clearly defined, splinting the right leaf of the diaphragm. The superior surface of the right lobe of the liver is also irregular.

tions, especially for *Schistosoma* ova were essentially normal.

A plain film of the abdomen failed to reveal any significant findings. A postero-anterior film of the chest was essentially normal except for a lobulation of the right leaf of the diaphragm (Fig. 1). No contrast study of the biliary system was done because of the high icterus index. An upper gastrointestinal series failed to show any evidence of a pancreatic neoplasm in the head, body, or tail of the pancreas. On fluoroscopy, however, it was noted that the lobulated contour of the right leaf of the diaphragm became exaggerated during deep inspiration and this segment showed limitation of motion when compared to the medial segment. A mass intrinsic or extrinsic to the diaphragm was immediately suspected. A diagnostic artificial pneumoperitoneum was induced with 300 c.c. of air through a right para-umbilical route. The recumbent films were not as significant as the upright film. The study clearly defined a fairly large mass arising from the superior surface of the liver, splinting the right leaf of the diaphragm (Fig. 2). The upper surface of the liver appeared irregular. The radiologic diagnosis was malignant tumor of the liver involving the superior aspect of the right lobe.

On exploration, the upper portion of the right lobe of the liver was found to be heavily infiltrated with multiple nodular masses, with a large mass protruding almost centrally from the superior surface. The inferior portion of the right lobe, the left lobe, and the caudate lobe appeared essentially normal.

The histopathological diagnosis was a primary neoplasm of the liver, a hepatoma.

CASE II: A 58-year-old Filipino housewife was operated upon fourteen months earlier in another hospital for a right ovarian carcinoma with minimal peritoneal implants. She did very well after an extensive course of external irradiation to the pelvis. Twelve months later she began to experience vague upper abdominal discomfort, especially after a full meal, but this she completely ignored because it was relieved by antacids. Her appetite was slightly impaired but she suffered no weight loss. During a periodic check-up, her doctor felt a doughy mass in the left upper quadrant, continuous with the splenic dullness three fingerbreadths below the left costal arch. The liver was also palpable to about the same distance below the right costal margin. A small amount of abdominal fluid was recognized, although the abdomen failed to show any significant enlargement. The patient was moderately obese.

A plain film of the abdomen taken in a private radiographic clinic confirmed the physical findings and was interpreted as indicating probable metastases to the liver and spleen from the primary focus in the right ovary.

The patient was referred to us for further work-up and possible radiation therapy. An abdominal film showed a soft-tissue mass in the left upper quadrant continuous with the splenic shadow, and the caudal extension of the liver shadow with its inferior border lying about an inch above the right iliac crest (Fig. 3, A). The chest film was essentially negative. The stomach was completely flexible to the palpating finger, with normal peristalsis during the fluoroscopic observation, but was displaced medially and anteriorly by the left soft-tissue mass (Fig. 3, B).

Routine laboratory examination of the blood,

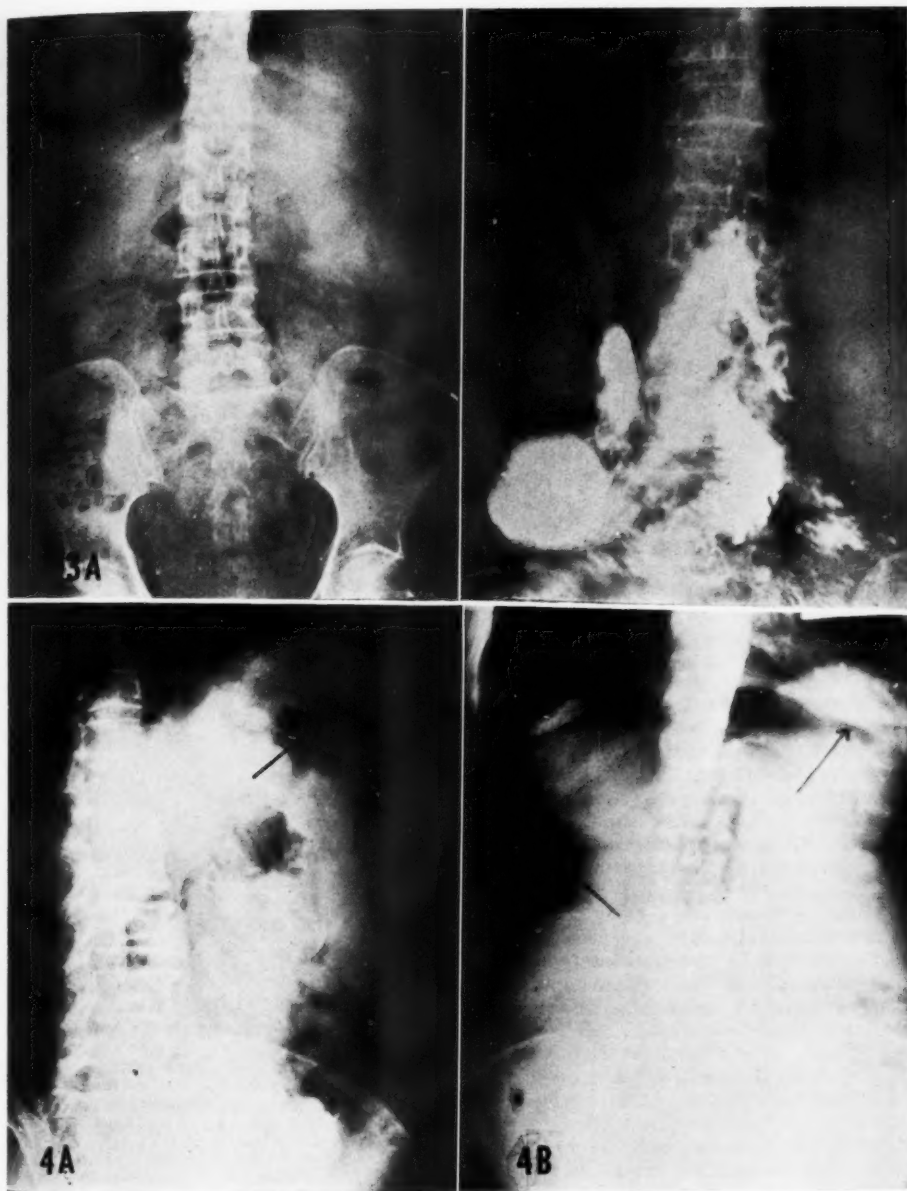


Fig. 3. Case II. A. Plain abdominal film. Note the seeming enlargement of the hepatic and splenic shadows, with both kidneys displaced downward. B. Film from gastrointestinal series. The stomach is displaced to the right by the left upper quadrant mass.

Fig. 4. Case II. After the introduction of 500 c.c. of air into the peritoneal cavity. A. Right anterior oblique film of the abdomen with the air (arrow) clearly defining the normal splenic shadow from the large omental mass in the left upper quadrant. B. Postero-anterior film of the abdomen with air column (arrows) demarcating the liver and spleen from these masses.

urine, and feces was essentially negative except for a mild anemia. Liver function tests were normal. A very small amount of serous fluid withdrawn from

the peritoneal cavity was positive for cancer cells.

It is rather unusual for carcinoma of the ovary to metastasize early to the spleen, and it was our feel-

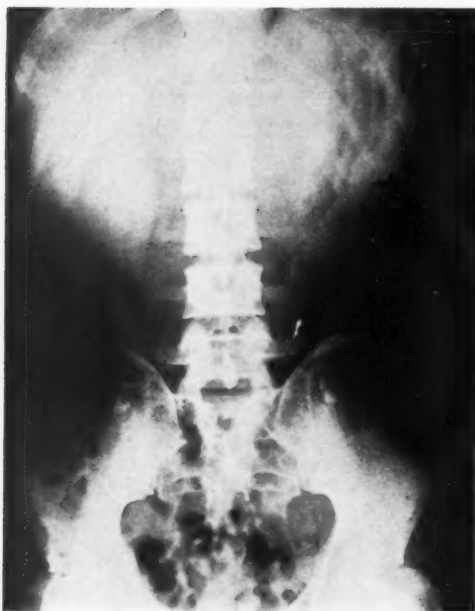


Fig. 5. Case III. Plain abdominal film before the introduction of air. The stomach, outlined by air, is displaced laterally by a mass medial to it. There is no significant enlargement of the right lobe of the liver.

ing that we were probably dealing with large mesenteric implants close to the spleen and liver, simulating hepatosplenomegaly. Diagnostic artificial pneumoperitoneum, with the introduction of 500 c.c. of air through a left para-umbilical route, showed these masses to be distinctly separate from the spleen and liver (Fig. 4).

Rotational deep radiation therapy was administered to both sides of the upper abdomen for a period of six weeks, followed by intraperitoneal administration of radioactive colloidal chromic phosphate. The masses regressed remarkably and the patient at her last visit was clinically well.

CASE III: A 53-year-old Chinese businessman was admitted to the hospital with a tender and painful mass in the epigastric region. This illness had begun three months earlier, with intermittent pain in the epigastric region radiating to the left upper quadrant, as well as to the back. This was accompanied by anorexia and a chronic weight loss. Two months after the onset, the pain became a constant dull ache, associated with intermittent rises of temperature, occasional vomiting, and a tender swelling of the epigastrium. A general practitioner prescribed several oral medications and daily intramuscular injections of penicillin-streptomycin for two weeks. Clinical improvement was slow, however, and hospital admission was sought.

The past diseases and personal history were not

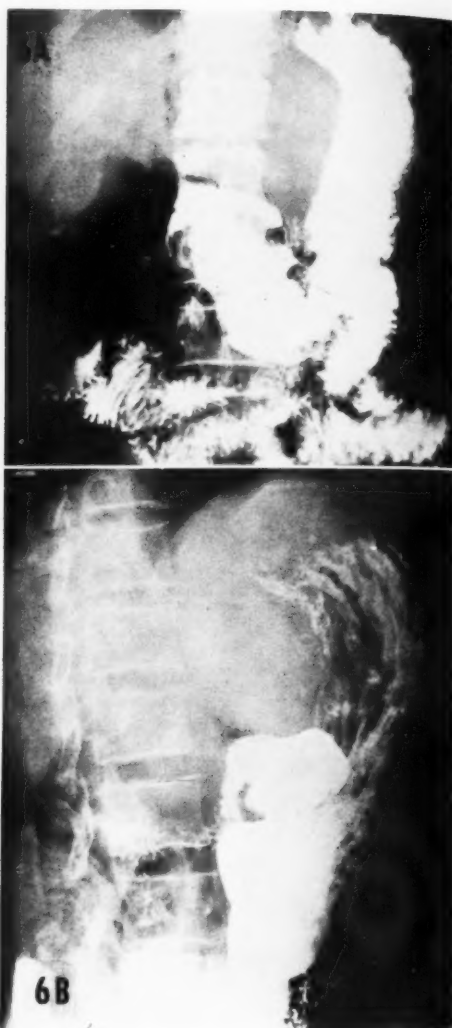


Fig. 6. Case III. Film from gastrointestinal series, with diagnostic artificial pneumoperitoneum (500 c.c. of air). A. Supine film showing the mass medial to and behind the stomach to be continuous with the left lobe of the liver. Note the nodular mass on the inferior surface of the right lobe of the liver. B. Right anterior oblique film showing retrogastric position of mass without distortion of the rugal pattern of the stomach.

relevant. The patient denied having had at any time the symptoms of amebic dysentery. He was well developed but moderately emaciated, with an apathetic appearance. Findings related to the head, neck, and chest were not significant except for relatively pale conjunctivae. The epigastrium was moderately rigid and tender, and a doughy, fixed, somewhat nodular mass, about the size of a fist, could be vaguely outlined.

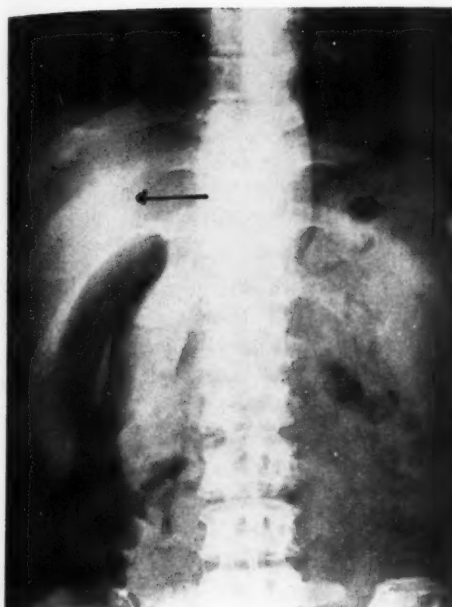


Fig. 7. Case IV. Diagnostic artificial pneumoperitoneum with 300 c.c. of air. Postero-anterior film clearly showing the slightly enlarged and nodular liver. Notice the central area of increased density (arrow) in the right lobe of the liver. A hard, fixed mass was palpable over this area, giving the impression of a mass closely connected with the anterior abdominal wall.

Laboratory examinations revealed a moderate anemia with a red cell count of 3,600,000 and a hemoglobin of 10.4 gm. The white cell count was slightly elevated, 10,200, with lymphocytes 58 per cent. Routine urinalysis and repeated stool examinations were negative. No amebic ova or parasites could be demonstrated at any time. Icterus index and liver function tests were within normal limits.

The chest roentgenogram revealed nothing significant. The plain film of the abdomen showed an ill-defined soft-tissue shadow in the epigastrium displacing the stomach, outlined by air contained within, laterally and inferiorly (Fig. 5). This was confirmed in the upper gastrointestinal study, where it was noted that the stomach was also displaced anteriorly, with its proximal half exhibiting some degree of fixation so that during fluoroscopy it was not entirely flexible to the palpating fingers, although normal peristalsis was observed. A diagnostic artificial pneumoperitoneum induced with 500 c.c. of air by way of a left para-umbilical route clearly outlined the enlarged nodular left lobe of the liver pressing on the stomach, with a large nodular mass in the inferior surface of the right lobe (Fig. 6). The radiographic impression after integration with the clinical data was multiple liver abscesses or cysts within the left lobe, probably due to amebiasis. It



Fig. 8. Case IV. Diagnostic artificial pneumoperitoneum, right translateral film of the abdomen made with a fine grid, showing clearly that the mass protruding in the epigastric region on the right arises from the right lobe of the liver.

was postulated that one of the abscesses must have ruptured into the lesser sac, involving the lesser omentum and consequently immobilizing the stomach with peritoneal adhesions. Because of the absence of any history of contact with sheep, the possibility of echinococcus cysts with secondary infection was only remotely considered.

At surgery, the nodular masses along the inferior surface of the left and right lobes of the liver demonstrated in the air study proved to be omental adhesions to the liver surface, involving both the lesser and greater omentum. These were also attached to the gastric wall, thus limiting the mobility of the stomach. No abscess or cysts could be demonstrated during the dissection. The histopathological examination revealed a chronic inflammatory process. No parasites could be demonstrated.

CASE IV: A 43-year-old Filipino businessman had been admitted to the hospital five months prior to the present admission, because of headache and dizziness recurrent after several similar episodes dating back two years. A general practitioner in his locality had informed him that he was hypertensive and had been treating him accordingly.

Physical examination during the first admission showed nothing remarkable except for a blood pressure of 170/100, which was more or less consistent, morning, noon, and evening, for three consecutive days without any specific therapy. Neurologic examination was completely negative, including funduscopy. The liver was not palpable.

Routine blood, urine, and fecal examinations were negative. A chest film and an intravenous pyelogram were both essentially normal. The supracrenal shadows were not unusual. A regitine test was normal.

The final diagnosis was essential hypertension, and the patient was discharged two weeks later much improved clinically.

The illness of the second admission apparently had no connection with that of the first admission. The chief complaint was the presence of a non-tender mass protruding from the epigastrium, especially toward the right, associated with a vague right upper quadrant pain, anorexia, weakness, and loss of weight of about 25 pounds in a period of three months. The illness dated back two months after the first admission, when it was manifested by impairment of appetite, consequent loss of weight, and right upper abdominal discomfort. At first, these symptoms were ascribed to the hypertensive diet. In the succeeding weeks, however, they progressed quite rapidly, the discomfort becoming a dull, constant ache. One month before the second admission, the upper abdomen started to enlarge and an epigastric mass gradually became prominent.

On admission, a mass, about the size of an orange, fixed and hard, non-tender, could be felt protruding from the epigastrium toward the right. It gave the impression of a superficial lesion closely related to the anterior abdominal wall. The liver was slightly enlarged, to about one fingerbreadth below the right costal margin and was hard and nodular. The patient was emaciated and pale. The blood pressure was 140/85.

The red cell count was 3,160,000, with a hemoglobin of 9.2 gm. The white cell count and differential count were normal. Routine urinalysis and fecal examinations disclosed nothing of significance. Determinations of liver function were all moderately elevated. The icterus index was normal.

A repeat chest film did not show any significant change except that the right leaf of the diaphragm was elevated. A plain abdominal film showed a slightly enlarged liver. A diagnostic artificial pneumoperitoneum was performed through a right para-umbilical route with 300 c.c. of air. The enlarged and nodular liver was beautifully demonstrated (Fig. 7), and in the translateral abdominal film the mass that protruded in the epigastrium,

which could be mistaken on palpation to be superficial, was definitely noted to arise from the liver without any connection at all with the anterior abdominal wall (Fig. 8).

The patient died two weeks after admission and autopsy verified the radiological findings. The histopathologic diagnosis was primary carcinoma of the liver, a hepatoma.

SUMMARY

The importance of artificial pneumoperitoneum as a diagnostic tool for upper intra-abdominal masses outside of the gastrointestinal tract is discussed. The procedure is simple and without untoward effects. It can be easily performed on outpatients. Several illustrative cases are cited.

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REFERENCES

1. ZEITLIN, N. S.: Diagnostic Pneumoperitoneum in Diaphragmatic Pathology. *Radiology* 14: 152-155, February 1930.
2. FAULKNER, W. B., JR.: Diaphragmatic Hernia and Eventration: Use of Pneumothorax in Differential Diagnosis. *Am. J. Roentgenol.* 45: 72-73, January 1941.
3. SANTE, L. R.: Pneumoperitoneum as an Aid in Pelvic Irradiation for Carcinoma of the Cervix. *Am. J. Roentgenol.* 46: 689-699, November 1941.
4. RÍO LEÓN, R., AND RODRÍGUEZ REMOS, C.: El pneumoperitonio artificial y la exploración radiológica del abdomen. *Arch. de med. int.* 4: 77-92, 1938.
5. ERDÉLYI, M., AND KERÉNYI, I.: Die Bedeutung des Pneumoperitoneums in der Behandlung der Lungentuberkulose und in der Bauchröntgendiagnostik. *Ztschr. Tuberk.* 93: 257-266, 1949.
6. CAMERINI, R., AND GUARDABASSI, L.: Il pneumoperitonio diagnostico nell'indagine radiologica dell'ipochondrio sinistro. *Arch. ital. mal. app. diger.* 16: 3-34, 1950.

SUMMARIO IN INTERLINGUA

Pneumoperitoneo Artificial Diagnostic

Es discutate le advantages del artificialmente inducite pneumoperitoneo pro le diagnose de massas supero-intra-abdominal foras del vias gastrointestinal. Le technica utilisate per le autor require le introduction de inter 300 e 500 cm³ de aere. Le patiente es allora placiante in decubito ventral du-

rante cinque minutas, con le capite del tabula elevate per circa 30 grados. Postea expositiones postero-anterior e oblique anterior dextere e sinistre e expositiones in position erecte as effectuante.

Es reportate plure casos in que iste procedimento se provava de valor.

Postoperative Investigation of the Ileal Bladder¹

LEE B. LUSTED, M.D.,² ARTHUR SHIP, M.D.,³ ROBERT R. SMITH, M.D.,
and JAMES R. JUDE, M.D.⁴

OF THE LATE complications following pelvic exenteration and uretero-ileal anastomosis, hydronephrosis and pyelonephritis are considered the most significant because of the ultimate effect on the longevity of the patient. When an isolated ileal segment has been substituted for the bladder, it is advisable to obtain repeated periodic intravenous urograms to determine urinary tract status. Transitory hydronephrosis is not an uncommon

tively served as a base line. Approximately one month after operation the urogram was repeated, and at that time a retrograde study of the ileal bladder was done. Intravenous urography was repeated thereafter at approximately monthly intervals, but further retrograde studies were made only if progressive hydronephrosis was demonstrated. Follow-up on most cases at the time of this report is twelve months.

CHART I.

Intravenous Urogram	Retrograde Ileal Bladder Study	Conclusion
I. Normal	A. No Ureteral reflux	1. Valve mechanism operates at uretero-ileal anastomotic site. No ureteral obstruction.
	B. Free ureteral reflux	2. No valve mechanism present. Probably no urinary tract infection.
II. Persistent or progressive hydronephrosis	C. No ureteral reflux	3. Ureteral obstruction at uretero-ileal anastomotic site.
	D. Free ureteral reflux	4. No ureteral obstruction. Urinary tract infection probably present.

postoperative finding (1) but progressive postoperative hydronephrosis requires an investigation to determine the cause. The purpose of this paper is to present the procedure used by the Surgery Service, National Cancer Institute, and the Diagnostic X-ray Department, Clinical Center, National Institutes of Health, to determine urinary tract status following uretero-ileal anastomosis.

MATERIAL AND METHOD

On 18 patients with advanced carcinoma of the cervix a pelvic exenteration with uretero-ileal anastomosis was performed, with a modified Bricker's procedure (3) for the uretero-ileal anastomosis. An intravenous urogram obtained preopera-

For the retrograde study, a Foley catheter with a 5-c.c. balloon was inserted in the ileal bladder orifice and under fluoroscopic control the bladder was filled with a dilute Hypaque solution obtained by adding 30 c.c. of 50 per cent Hypaque to 100 c.c. of water. The solution was placed in barium enema equipment previously well cleansed with benzalkonium chloride, and 1 gram of Neomycin was added.

Ureteral reflux, if it were going to occur, was usually noted before the ileal bladder was filled. As soon as the reflux was seen in the bladder, filling was discontinued. If no reflux was observed, the ileal bladder was filled to maximum capacity and the catheter was clamped.

Three anteroposterior roentgenograms

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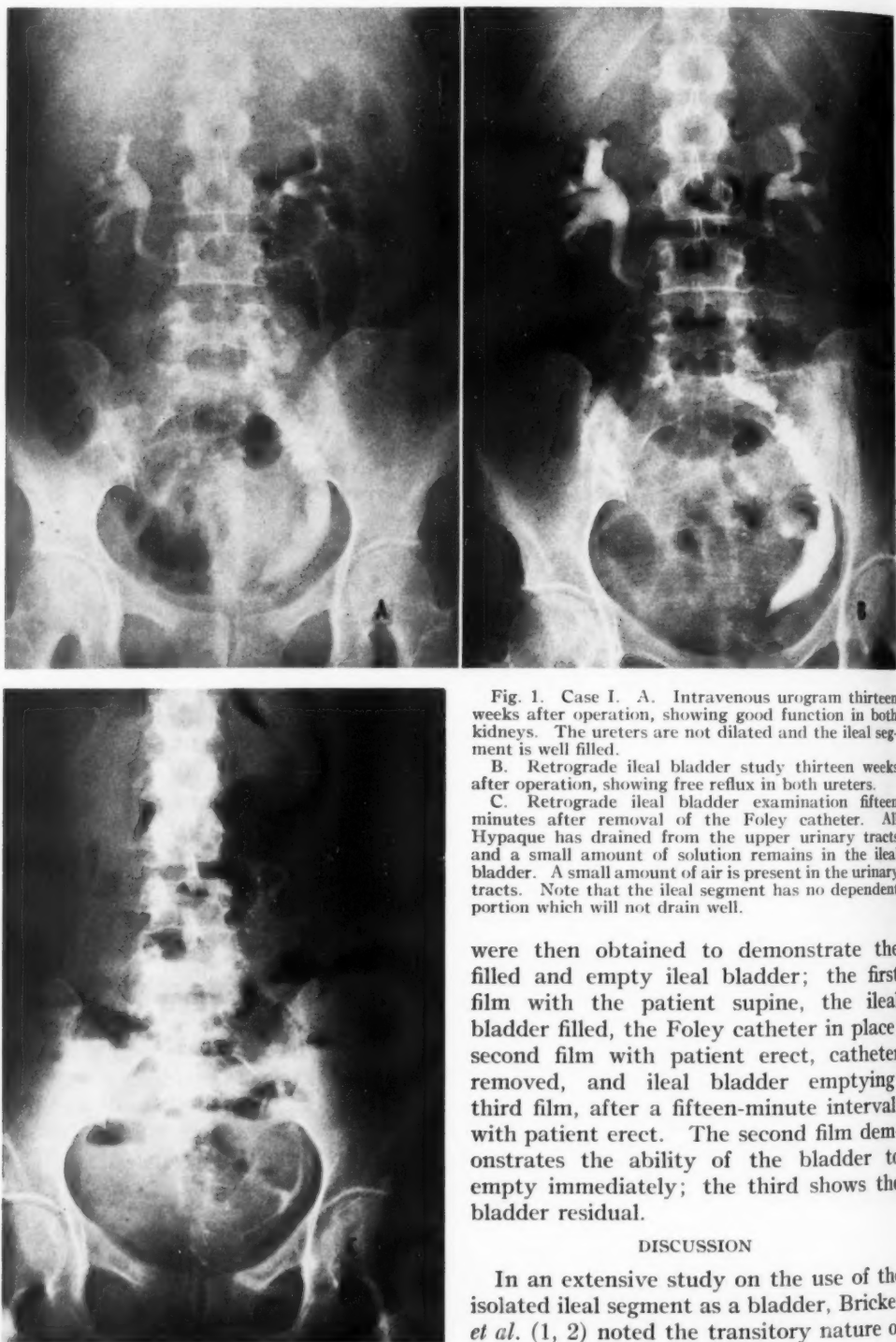


Fig. 1. Case I. A. Intravenous urogram thirteen weeks after operation, showing good function in both kidneys. The ureters are not dilated and the ileal segment is well filled.

B. Retrograde ileal bladder study thirteen weeks after operation, showing free reflux in both ureters.

C. Retrograde ileal bladder examination fifteen minutes after removal of the Foley catheter. All Hypaque has drained from the upper urinary tracts and a small amount of solution remains in the ileal bladder. A small amount of air is present in the urinary tracts. Note that the ileal segment has no dependent portion which will not drain well.

were then obtained to demonstrate the filled and empty ileal bladder; the first film with the patient supine, the ileal bladder filled, the Foley catheter in place; second film with patient erect, catheter removed, and ileal bladder emptying; third film, after a fifteen-minute interval, with patient erect. The second film demonstrates the ability of the bladder to empty immediately; the third shows the bladder residual.

DISCUSSION

In an extensive study on the use of the isolated ileal segment as a bladder, Bricker *et al.* (1, 2) noted the transitory nature of

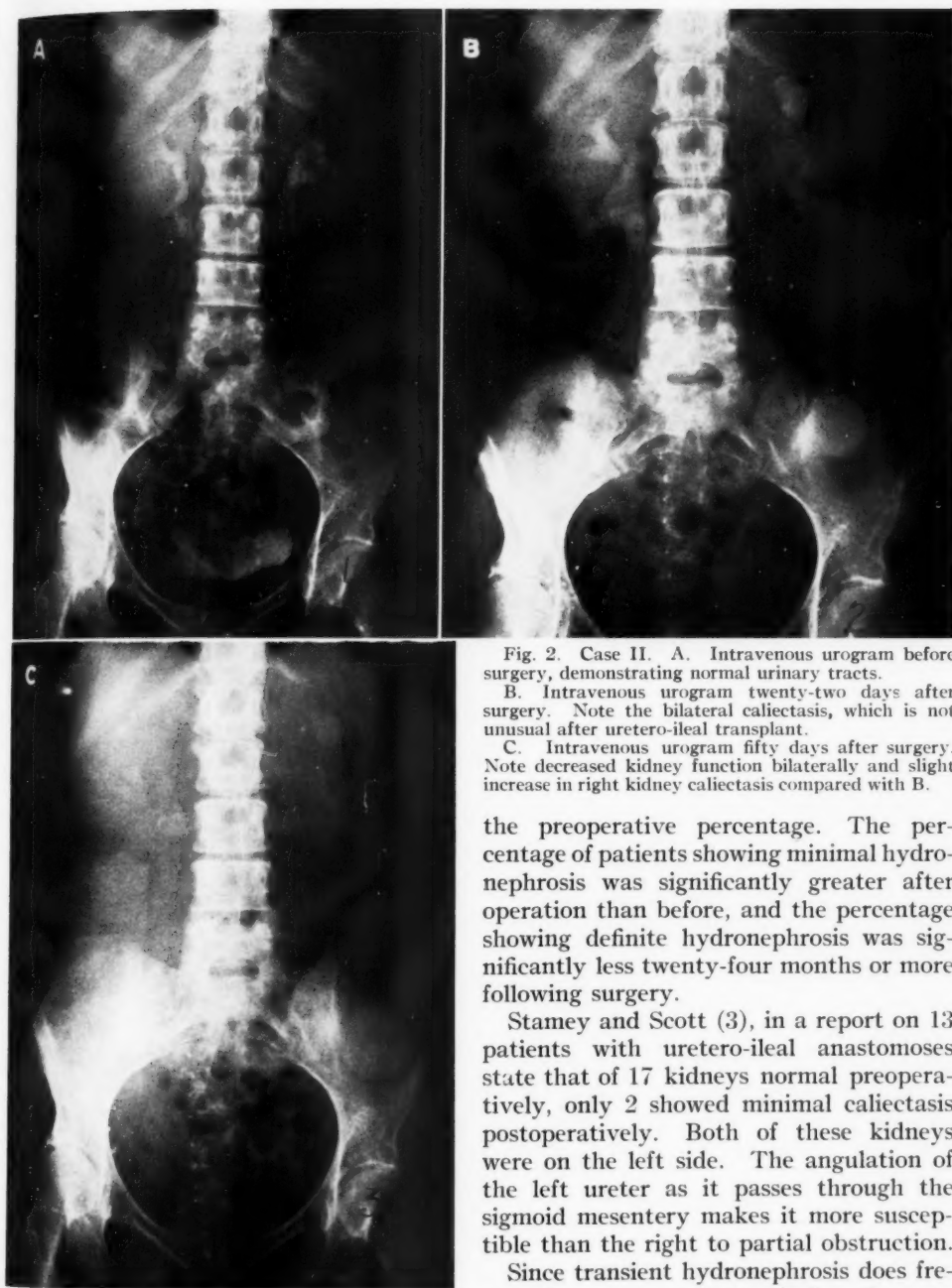


Fig. 2. Case II. A. Intravenous urogram before surgery, demonstrating normal urinary tracts.

B. Intravenous urogram twenty-two days after surgery. Note the bilateral caliectasis, which is not unusual after uretero-ileal transplant.

C. Intravenous urogram fifty days after surgery. Note decreased kidney function bilaterally and slight increase in right kidney caliectasis compared with B.

the preoperative percentage. The percentage of patients showing minimal hydronephrosis was significantly greater after operation than before, and the percentage showing definite hydronephrosis was significantly less twenty-four months or more following surgery.

Stamey and Scott (3), in a report on 13 patients with uretero-ileal anastomoses state that of 17 kidneys normal preoperatively, only 2 showed minimal caliectasis postoperatively. Both of these kidneys were on the left side. The angulation of the left ureter as it passes through the sigmoid mesentery makes it more susceptible than the right to partial obstruction.

Since transient hydronephrosis does frequently occur postoperatively, the surgeon would like to know as soon as possible whether or not it is due to partial obstruction of the ureter. Intravenous urograms repeated periodically will, of course, dem-

hydronephrosis occurring after uretero-ileal anastomosis. In Bricker's series of cases (1) the percentage of normal pyelograms thirty months postoperative equaled

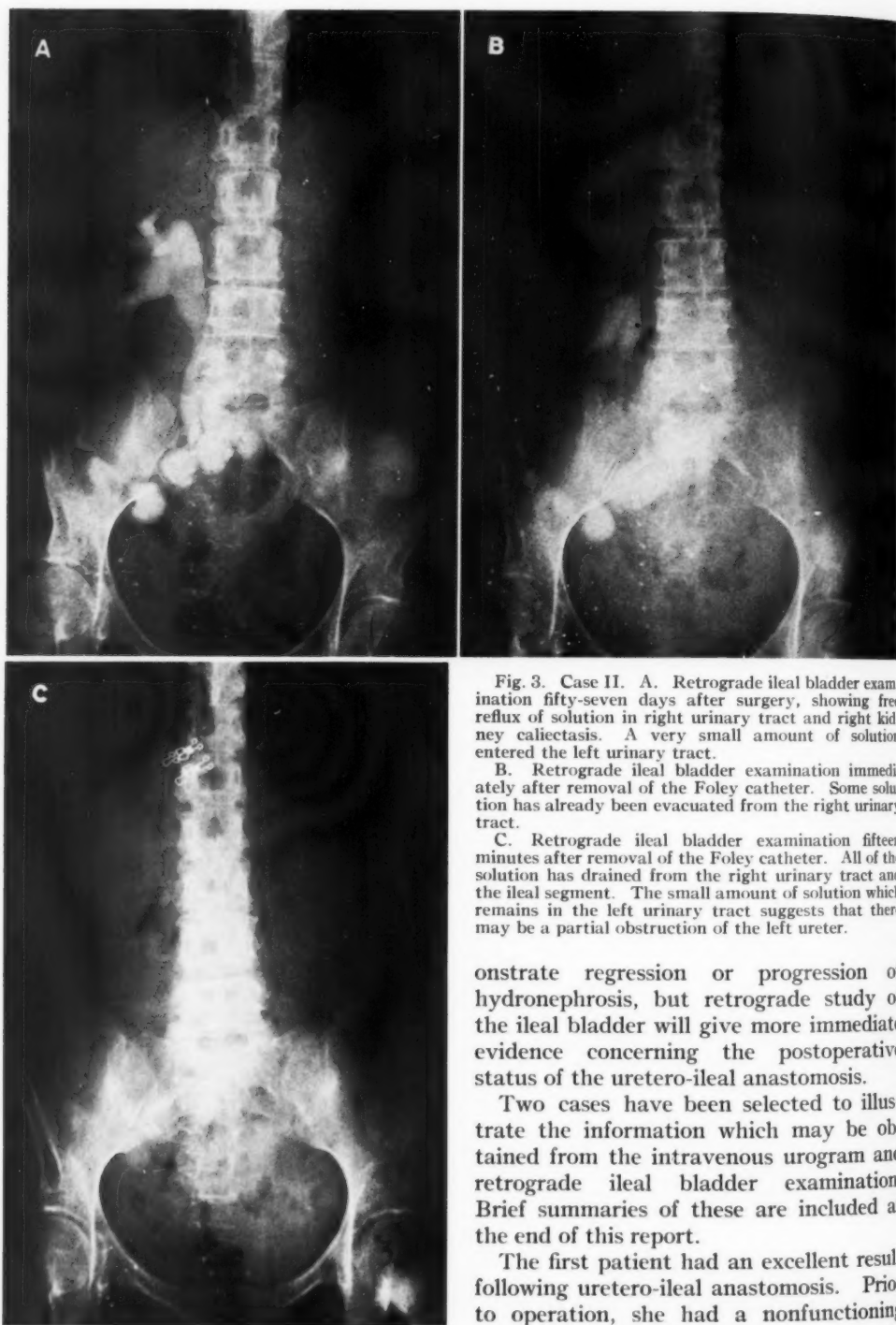


Fig. 3. Case II. A. Retrograde ileal bladder examination fifty-seven days after surgery, showing free reflux of solution in right urinary tract and right kidney caliectasis. A very small amount of solution entered the left urinary tract.

B. Retrograde ileal bladder examination immediately after removal of the Foley catheter. Some solution has already been evacuated from the right urinary tract.

C. Retrograde ileal bladder examination fifteen minutes after removal of the Foley catheter. All of the solution has drained from the right urinary tract and the ileal segment. The small amount of solution which remains in the left urinary tract suggests that there may be a partial obstruction of the left ureter.

onstrate regression or progression of hydronephrosis, but retrograde study of the ileal bladder will give more immediate evidence concerning the postoperative status of the uretero-ileal anastomosis.

Two cases have been selected to illustrate the information which may be obtained from the intravenous urogram and retrograde ileal bladder examination. Brief summaries of these are included at the end of this report.

The first patient had an excellent result following uretero-ileal anastomosis. Prior to operation, she had a nonfunctioning

right kidney. Figure 1 shows the intravenous urogram and retrograde ileal bladder study approximately three months postoperatively. The right kidney functions well and only minimal caliectasis remains. The retrograde study shows free reflux of solution in the ureters and fifteen minutes after removing the catheter only a small amount of solution remains in the ileal segment. The intravenous urogram and retrograde bladder study showed conclusively that the uretero-ileal anastomoses were intact and the ileal bladder was so constructed that it emptied well.

The retrograde bladder study supplied useful information concerning the problem presented after operation in Case II. This patient had a normal urogram prior to operation (Fig. 2). Approximately three weeks after operation, the urogram showed bilateral caliectasis, a finding so common at this postoperative stage that there was little cause for concern. Approximately six weeks after operation, however, the urogram showed an increase in the right caliectasis and a decrease in kidney function bilaterally. An important observation was a resistant urinary tract infection which developed postoperatively and which improved slowly with Chloromycetin therapy during this six-week period.

Because the right kidney showed progressive caliectasis, a retrograde study of the ileal bladder was done. Free flow of solution up the right ureter was demonstrated, while a very small amount of solution was able to enter the left ureter (Fig. 3, A). After the catheter was removed, the right urinary tract showed satisfactory emptying (Fig. 3, B), and fifteen minutes later (Fig. 3, C) the urinary tract and ileal bladder contained no demonstrable Hypaque.

The retrograde examination demonstrated that the increased caliectasis of the right kidney was not the result of ureteral obstruction. The urinary tract infection may have been responsible for the changes. It seems likely that there

was a partial obstruction of the left ureter at the anastomotic site since very little Hypaque entered the left ureter.

Some helpful conclusions concerning the status of uretero-ileal anastomosis may be drawn from an examination which combines the retrograde study and an intravenous urogram (Chart I). Examples of each of the four conclusions in this chart have been found in the patients studied thus far. Two of the conditions are of particular interest: First, the combination of a normal intravenous urogram and no ureteral reflux suggests that a valve mechanism is present at the uretero-ileal anastomotic site. It would be helpful to know whether a particular type of anastomosis will act as a valve. Second, is the combination of persistent or progressive hydronephrosis with free ureteral reflux. Further observations will probably show that free ureteral reflux occurs with progressive hydronephrosis and that, if free ureteral reflux is found, reoperation is not necessary. Future studies with the present technics and cinefluorography should give more definite information concerning these two conditions.

CONCLUSION

The intravenous urogram and retrograde ileal bladder examination is a worthwhile combined postoperative procedure to demonstrate the emptying ability of the ileal bladder and the status of the uretero-ileal anastomosis.

CASE SUMMARIES

CASE I: F. U., a 47-year-old female with carcinoma of the cervix Stage V (League of Nations) had previously received radiation therapy with intravaginal radium and external irradiation to the pelvis. A preoperative urogram showed no function of the right kidney. The left urinary tract was normal.

Pelvic exenteration was done and the ureters were implanted in an isolated segment of ileum on Nov. 26, 1956.

Postoperative urograms showed return of function in the right kidney. An intravenous urogram and retrograde ileal bladder study, on April 4, 1957 (Fig. 1), showed essentially normal urinary tracts.

CASE II: B. H., a 46-year-old female with carcinoma of the cervix Stage III (League of Nations), had received intravaginal and external x-ray irradiation. A preoperative urogram showed no evidence of urinary tract obstruction (Fig. 2, A). Pelvic exenteration was done and the ureters were implanted in an isolated ileal loop on July 31, 1957. An intravenous urogram showed bilateral caliectasis, more pronounced on the left (Fig. 2, B).

Following operation, a urinary tract infection developed and there was still residual infection fifty days after surgery (Fig. 2, C). The patient improved steadily, and a retrograde ileal bladder study fifty-seven days after surgery showed free reflux and good emptying in the right urinary tract with very little reflux in the left urinary tract

(Fig. 3). The clinical course continued to be satisfactory.

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REFERENCES

1. BRICKER, E. M., BUTCHER, H. R., AND McAFEE, C. A.: The Late Results of Bladder Substitution with Isolated Ileal Segments. *Surg., Gynec. & Obst.* 99: 469-482, October 1954.
2. KLINGE, F. W., AND BRICKER, E. M.: The Evacuation of Urine by Ileal Segments in Man. *Ann. Surg.* 137: 36-40, January 1953.
3. STAMEY, T. A., AND SCOTT, W. W.: Ureteroileal Anastomosis. *Surg., Gynec. & Obst.* 104: 11-24, January 1957.

SUMMARY IN INTERLINGUA

Investigation Post-Operatori Del Vesica Ileal

Quando, post exenteration pelvica, un isolate segmento ileal es substituite pro le vesica, il es desirabile determinar le stato del vias urinari a intervallos regular. Urographia intravenose e studios retrograde del vesica ileal demonstra le capacitate vacuatori del vesica ileal e le stato del anastomose uretero-ileal.

Le technica es describe como illo esseva usate in le casos de 18 patientes. Un urogramma intravenose es obtenite ante le

operation e usate como linea de base. Circa un mense post le operation le urogramma es repetite, e un studio retrograde del vesica ileal es effectuate. Urogrammas intravenose es repetite subsequentemente a intervallos mensural, sed nove studios retrograde es considerate como necessari solamente quando hydronephrose progressive ha essite demonstrate.

Duo casos illustrative, observate per le autores, es reportate.



The Clinical Significance of "SR" (Sensitization Response to Radiation) in Normal Vaginal Mucosa¹

RAYMOND R. LANIER, Ph.D., M.D.,² and WALTER T. WIKLE, M.D.³

IT WOULD BE advantageous to know if certain patients with carcinoma of the cervix will fail to respond to radiation treatment, no matter how well it may be administered. That this may be so is attested by the fact that all of us have some failures even in the early stages of the disease. If these cases could be detected, surgery might be undertaken earlier, with greater chances for survival. This report is a commentary on an attempt to set these patients apart.

Some women, while undergoing radiation therapy for carcinoma of the cervix, have certain distinctive changes in Papanicolaou smears of epithelium desquamated from an otherwise normal vagina. R. M. and J. B. Graham (1-4) have listed these changes—increase in cell size, nuclear degeneration, and vacuolization and abnormal staining reactions of cytoplasm—and have named the phenomenon "radiation response," or "RR." It is their belief that it is correlated with a patient's chance for five-year survival, after treatment with x-rays and radium. This hypothesis is based on 125 cases of cervical cancer in which the percentage of "RR" type cells in the desquamated epithelium was determined during treatment (Table I). It was found that of those patients who had 75 per cent or more "RR" cells 59 per cent survived for five years following therapy; only 3 per cent who had less than 65 per cent "RR" cells lived for so long a period.

The Grahams later reported (5) a correlation between five-year survival rate following radiation treatment of cervical carcinoma and changes in the appearance of "basal" cells in Papanicolaou-stained

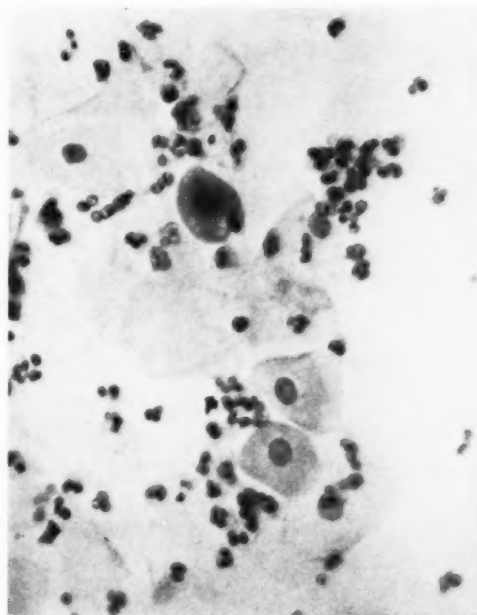


Fig. 1. Papanicolaou smear, vaginal epithelium. The deeply stained cell in the left upper field illustrates "SR" changes in the basal noncancerous epithelium.

vaginal smears *before* radiation. In this instance the criterion was the percentage of cells which looked as though they had

TABLE I: SUMMARY OF RESPONSES IN 125 CASES RECEIVING RADIATION THERAPY (GRAHAM AND GRAHAM)

	Good Response ($>75\%$ epithelial cells show change)			Poor Response ($<65\%$ epithelial cells show change)		
	No. of Cases	5-yr. Survivals No.	%	No. of Cases	5-yr. Survivals No.	%
Stage I	11	8	73	0	0	..
Stage II	31	22	70	22	0	..
Stage III	16	6	37	26	1	4
Stage IV	4	0	..	12	1	8
Total	62	36	59	63	2	3

¹ Presented at the Forty-third Annual Meeting of the Radiological Society of North America, Chicago, Ill., Nov. 17-22, 1957. This work was made possible through the financial assistance of the Pueblo (Colo.) Chapter of the American Cancer Society.

² Deceased. Former Professor of Radiology, University of Colorado Medical Center, Denver, Colo.

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been irradiated, but had not. These showed vacuolization, red granules in an abnormally staining pink cytoplasm, increased size, etc. (Fig. 1). This phenomenon was labeled "sensitization response," or "SR," as it seemed a prediction

of efficacy of radiation therapy—how "sensitive" to it the cancer would be. In a review of 100 unselected cervical cancer patients, a 66 per cent five-year survival was found among patients in whom 10 per cent or more of the noncan-

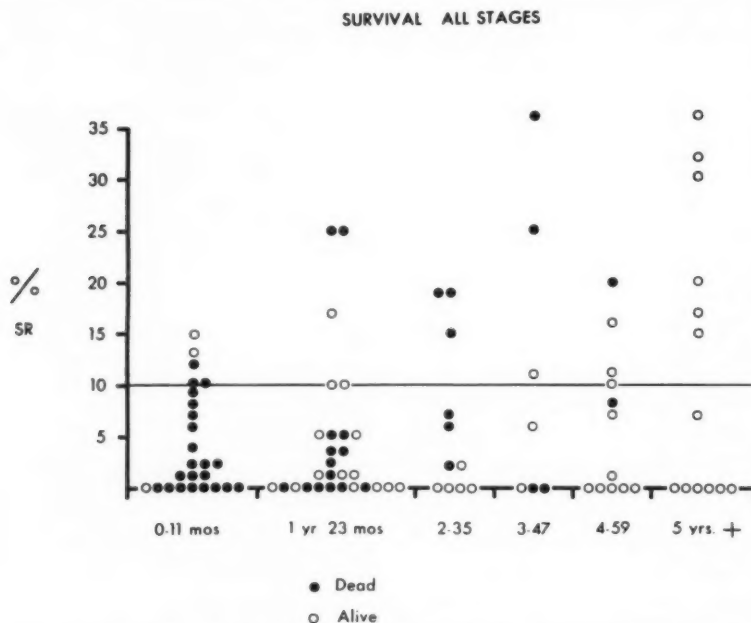


Fig. 2. Scattergram showing percentage of "SR" for all patients in all stages of cancer plotted against time elapsed since diagnosis and treatment.

TABLE II: FIVE-YEAR "CURE" IN CANCER OF THE CERVIX PATIENTS ACCORDING TO CLINICAL STAGE AND PRESENCE OR ABSENCE OF SIGNIFICANT SR (GRAHAM AND GRAHAM)

Stage	I	II	III	IV	I-IV
Patients with significant SR*		20			35
No. living and well at 5 yr.	4	14	5	..	23
	(57%)	(70%)	(62%)		(66%)
Patients without significant SR†	9	25	20	11	65
No. living and well at 5 yr.	4	7	0	1	12
	(44%)	(28%)		(9%)	(18%)
All patients	16	45	28	11	100
No. living and well at 5 yr.	8	21	5	1	35
	(50%)	(47%)	(18%)	(9%)	(35%)

* 10 per cent or more of nonmalignant epithelial cells in the vaginal smear show SR.

† 9 per cent or less of nonmalignant epithelial cells in the vaginal smear show SR.

cerous basal cells showed "SR," while the five-year survival for those with less than 9 per cent of the cells showing "SR" was only 18 per cent (Table II). It thus appeared that "RR" and "SR," if proved valid and reliable, might be of clinical value in the differential selection of cervical cancer patients for post-irradiation surgery. With this in mind, we undertook an investigation of "SR."

Beginning in 1950, we had made and retained Papanicolaou preparations of most cervical carcinomas prior to irradiation. These slides now enabled us to evaluate these patients, in retrospect, for "SR" and consider the findings in the light of post-treatment survival.

We have taken great care to ensure that our cytological interpretations conform to

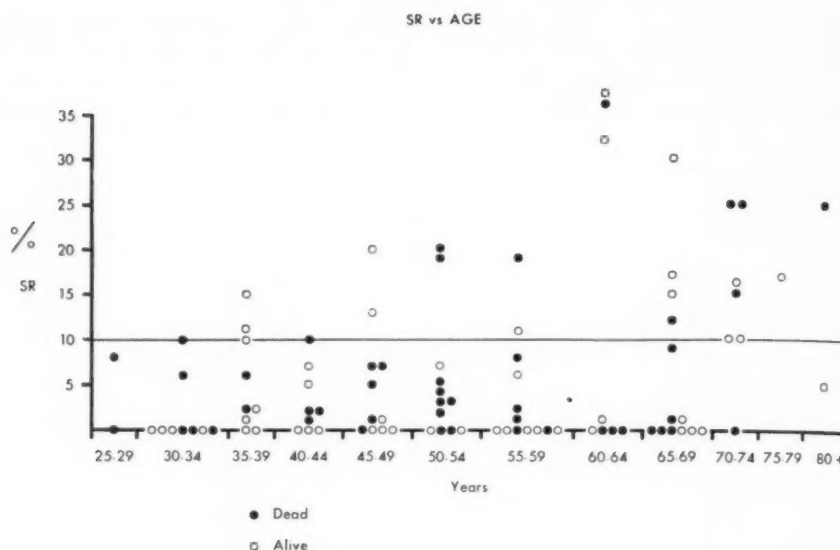


Fig. 4. Relation of "SR" to age of patient.

Finally, among our patients surviving after radiation therapy, there was no statistically significant difference in the "SR" cytological changes in the living and the dead:

Living

With good "SR" . . . 15/26 ($58 \pm 9.6\%$)

With poor "SR" . . . 33/70 ($47 \pm 6.0\%$)

Dead

With good "SR" . . . 11/26 ($42 \pm 9.6\%$)

With poor "SR" . . . 37/70 ($53 \pm 6.0\%$)

It is apparent that the total number of patients showing a good "SR" (26/96 = 27 per cent) is considerably less than the percentage of five-year survivors, about 40 per cent, now being seen after adequate x-ray therapy in most institutions. If radiation-cured patients included only those with good "SR" in our series, a cure rate of about 30 per cent would be the maximum to be expected.

The problem thus remains: What is the significance of the "SR" changes? We do not know. We agree with the Grahams and others that the changes are real, not artefacts of preparation or staining. They do resemble radiation changes as seen under the microscope. It may be

logical to assume, therefore, that they are similar degenerative changes produced in the cytoplasm by some unknown agent or process.

With respect to "RR," an evaluation is now in progress.

SUMMARY AND CONCLUSIONS

A cytological change in normal vaginal epithelium from the basal, cell layer of patients with carcinoma of the cervix has been described ("SR") and correlated by other investigators with curability by radiation therapy. We have attempted to make this correlation in 96 patients examined for "SR" and treated by radiation therapy within the last five years at the University of Colorado Medical Center. We have been unable to correlate "SR" with age of patient, stage of disease, or survival after treatment in this series.

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REFERENCES

1. GRAHAM, R. M.: The Effect of Radiation on Vaginal Cells in Cervical Carcinoma. I. Description of Cellular Changes. II. The Prognostic Significance. *Surg., Gynec. & Obst.* **84**: 153-165; 166-173, February 1947.

2. GRAHAM, J. B., AND GRAHAM, R. M.: The Modification of Resistance to Ionizing Radiation by Humoral Agents. *Cancer* 3: 709-717, 1950.
3. GRAHAM, R. M.: The Prognosis of Cancer of the Cervix by Vaginal Smear; Correlation with Five-Year Results. *Surg., Gynec. & Obst.* 93: 767-774, December 1951.
4. GRAHAM, J. B., AND GRAHAM, R. M.: A Method of Enhancing the Effectiveness of Radiotherapy in Cancer of the Uterine Cervix. *Cancer* 6: 68-76, January 1953.
5. GRAHAM, R. M., AND GRAHAM, J. B.: A Cellular Index of Sensitivity to Ionizing Radiation: The Sensitization Response. *Cancer* 6: 215-223, 1953.

SUMMARIO IN INTERLINGUA

Le Signification Clinic De "RS" (Responsa de Sensibilisation a Radiation) In Normal Mucosa Vaginal

Se trova describe in le litteratura un alteration cytologic in le normal epithelio vaginal in patientes con carcinoma del cervice uterin. Preparatos colorate secundo Papanicolaou exhibi cellulas que ha le apparentia de haber essite irradiate, ben que isto non es le caso. Tal cellulas es characterisate per vacuolisation, granulos rubie in un cytoplasma de anormal colorabilitate rosa, e augmento del dimensiones.

Iste phenomeno, designate como "RS" (responsa de sensibilisation), ha essite correlationate per previe investigadores con curabilitate per therapia radiational. Tamen, le presente autores in un studio de 96 patientes recipiente radiotherapia pro cancro cervical ha non potite demonstrar un tal correlation. Similmente, nulle correlation con le etates del patientes o le stadio del morbo esseva apparente.



Simplified Phlebography of the Inferior Vena Cava in Urologic Diagnosis¹

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ALTHOUGH NUMEROUS methods of evaluating retroperitoneal disease are available to the urologic surgeon, visualization of the inferior vena cava is seldom used. Since the procedure was first suggested by Dos Santos in 1935 (4), the radiographic contrast technics described in the literature have been varied but cumbersome and therefore poorly accepted. This is emphasized by an extensive review of radiologic aids in the diagnosis of retroperitoneal tumors (7), listing thirteen procedures but making no mention of contrast filling of the inferior vena cava. The complicated technic described, requiring venous cut down (8), catheters, (10), bilateral injections (11), serial filming (3), transosseous injections (20), and trans-lumbar vena caval puncture (11) are probably responsible to a large extent for the poor acceptance of this procedure.

We have used a simpler, safer, and equally diagnostic technic in 85 studies and believe this method to be generally applicable even in the investigation of outpatients.

TECHNIC

No premedication is necessary, omission of the previous meal being the only preparation routinely employed. The patient lies supine on the radiographic table in a 10° Fowler's position and scout films are obtained. These include an antero-posterior projection with a Bucky grid and a lateral view with a horizontal beam and grid cassette. The roentgenograms thus obtained obviate positional changes by the patient. While the preliminary films are being developed, the right femoral area is cleansed with an antiseptic solution. The

femoral arterial pulse is palpated 1 cm. below the inguinal ligament and a local anesthetic infiltrated into the skin and deeper tissues medial to the artery. The scout films are viewed and any adjustment in technic is made at this time.

A 3-inch, 17-gauge, 45°-beveled needle is inserted percutaneously into the femoral vein. While blood is continuously withdrawn into a syringe, the needle is advanced 2 cm. within the lumen of the vein. This secure placement of the needle diminishes the possibility of extravasation. The posterior course of the external iliac vein immediately superior to the inguinal ligament must be borne in mind as the needle is advanced. A plastic tube is connected to the needle and both are taped to the thigh of the patient. The patency of the needle is maintained by a normal saline infusion.

A test dose of 1 c.c. of contrast material is injected in an attempt to determine iodine sensitivity and possible extravasation, which is manifested by local pain. A sphygmomanometer cuff is placed on the opposite thigh as cephalad as possible and the pressure raised to 200 mm. Hg prior to the injection. This diminishes distortion and dilution of the contrast column by blood from the opposite extremity. A cuff is not placed on the ipsilateral thigh because the continuous flow of venous blood is desirable for preventing prolonged contact of the contrast material with the intima of the vein, thereby reducing the possibility of thrombophlebitis.

Thirty cubic centimeters of 50 per cent Miokon is injected within four seconds while the patient inspires normally. The lateral film is exposed at the end of the

¹ From the Departments of Radiology and Urology, U. S. Naval Hospital, St. Albans, N. Y. The opinions expressed are those of the authors and do not necessarily reflect the views of the Medical Department or the Department of the Navy. Accepted for publication in May 1958.

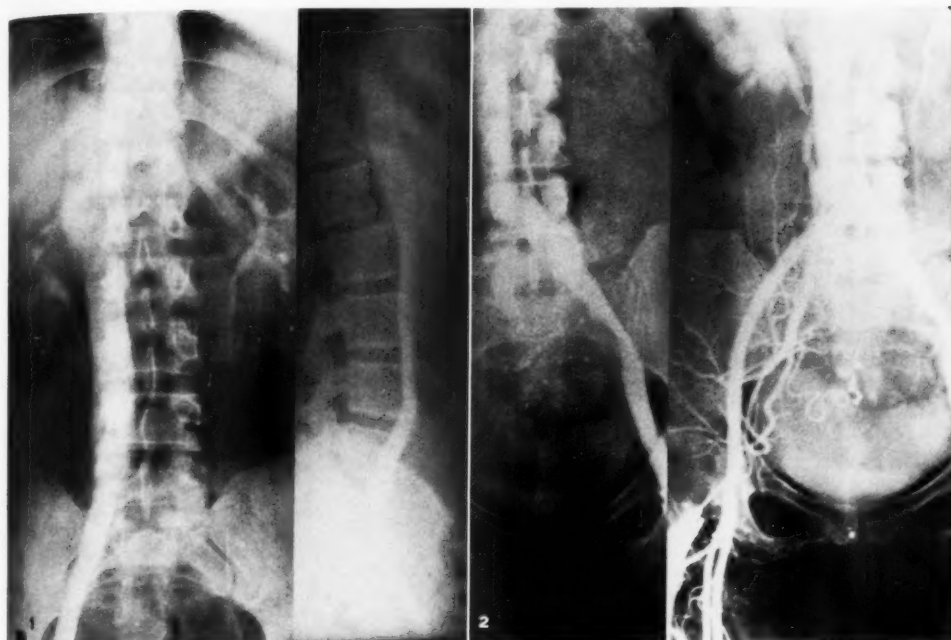


Fig. 1. Anteroposterior and transabdominal lateral views of the normal inferior vena cava outlined with contrast material. Note the relationship of the vessel to the spine and urinary tract and the inflow of blood from the right renal vein at L-1-2. The lateral view demonstrates the posterior course of the external iliac vein. This explains the necessity for directing the needle posteriorly.

Fig. 2. Inferior vena cavagram on the left, showing flattening and distortion of the left common iliac vein overlying L-4-5. The combined right retrograde femoral arteriogram and left femoral vein injection illustrates the compression of this vein by the common iliac arteries.

injection and at the height of inspiration. This film demonstrates the anterior and posterior contours of the vena cava and the relationship to the vertebral bodies without overlap of the urinary collecting system. Approximately ten minutes after this injection, a second injection is made and an anteroposterior film is exposed. This film demonstrates the lateral margins of the vena cava and also visualizes the renal collection system, pelves, and ureters, and their relationship to the former structure.

The needle is then withdrawn, pressure is applied for five minutes, and the patient is observed for fifteen minutes, during which time pyelograms, of retrograde quality, are obtained. This effect is due to the larger volume of contrast material injected.

A normal inferior vena cavagram and subsequent pyelogram are reproduced in Figure 1. Figure 2 shows the reason for

preferring a right-sided femoral injection except in the case of a left pelvic mass.

Significant morbidity has been no greater than with routine intravenous pyelography. There has been no thrombophlebitis as a result of the procedure.

INDICATIONS

Indications for phlebography of the inferior vena cava in the field of urology include:

1. Diagnosis and localization of primary retroperitoneal tumors.
2. Diagnosis and localization of metastatic tumors, especially of testicular origin.
3. Demonstration of retrocaval ureters.
4. Diagnosis of thrombosis by clot or tumefaction in the renal vein or vena cava. The former may be manifested by an absence of the normal jet of venous blood entering the opacified vena cava at the level of the renal pedicle. In regard



Figs. 3 and 4. Case I: Embryonal-cell carcinoma of right testicle.

Fig. 3. Left: Preoperative inferior vena cavagram demonstrating marked narrowing of the inferior vena cava at L-4, with lateral displacement of the ureter. The vena cava above this level is also displaced laterally. At surgery a large mass of retroperitoneal nodes was found encircling the vena cava at L-4 and displacing it laterally.

Right: Postoperative study, showing the vena cava only slightly narrowed at L-4, with a return, together with the right ureter, to normal anatomical position. Left retroperitoneal node dissection revealed metastases.

Fig. 4. Left: Inferior vena cavagram five months after surgery and postoperative radiation to a tumor dose of 3,000 r completed Nov. 1, 1957. Normal inferior vena cava and pyelogram.

Right: A repeat study two weeks later, done because of vague abdominal discomfort, reveals poor renal function on the left, with hydronephrosis on the right and scalloping of the inferior vena cava from recurrent tumor at L-4.

to the latter condition, it is interesting to note that 50 per cent of patients with complete inferior vena caval obstruction are symptomless (12, 17).

5. As a follow-up to determine the results of surgical or roentgen therapy and as an index to the need for further therapy before symptoms occur.

6. Demonstration of vena caval anomalies due to persistence of various parts of the cardinal venous system.

The only *contraindications* are sensitivity to iodine, active thrombophlebitis in pelvic or lower extremity veins, and severe concurrent renal and hepatic disease.

Figures 3-7 illustrate the usefulness of the procedure in some cases seen within the past year at this hospital.

Fig. 5. Case I. Following an additional tumor dose of 3,000 r to the L-2-5 area, the scalloping of the inferior vena cava and right hydronephrosis have disappeared, and marked improvement in renal function on the left is demonstrated. →

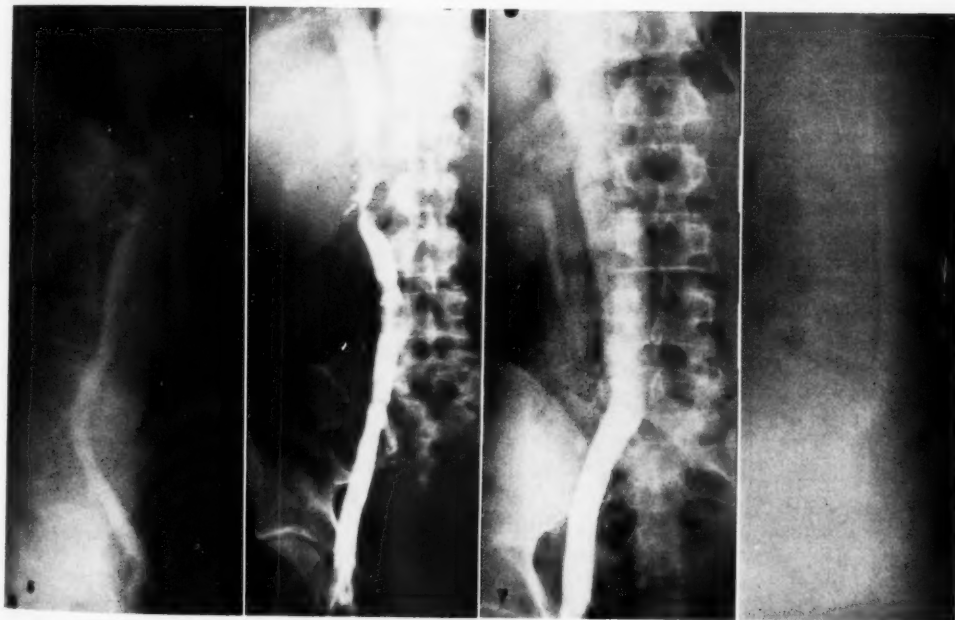


Fig. 6. Case II. Postoperative inferior vena cavagram on a 52-year-old white male who had a right nephro-ureterectomy elsewhere for transitional-cell carcinoma of the renal pelvis. At surgery numerous nodes about the renal hilus were found. Note the marked deformity and anterior displacement of the inferior vena cava at this level.

Fig. 7. Case III. This patient had a right orchiectomy, and a diagnosis of adult teratoma of the testicle was made. Study of the inferior vena cava revealed lateral displacement of this vessel at the T-12 to L-2 level, but no scalloping or anterior elevation. A right retroperitoneal node dissection through a thoraco-abdominal incision was performed, showing the abnormal course of the inferior vena cava to be due to aberrant renal arteries which encircled and displaced the inferior vena cava at L-1.

SUMMARY

A simple, safe, and rapid method of visualizing the inferior vena cava has been presented, with illustrative cases. It is hoped that this office procedure will gain acceptance by the profession as a valuable aid in urologic diagnosis and management.

REFERENCES

1. ANDERSON, R. C., HEILIG, W., NOVICK, R., AND JARVIS, C.: Anomalous Inferior Vena Cava with Azygos Drainage: So-called Absence of Inferior Vena Cava. *Am. Heart J.* **49**: 318-322, February 1955.
2. BEER, E.: Some Aspects of Malignant Tumors of the Kidney. *Surg., Gynec. & Obst.* **65**: 433-446, October 1937.
3. COUVELAIRE, R., AND AUVERT, J.: La phlebographie cave inférieure dans l'exploration des tumeurs du rein droit. *J. urol. Paris* **62**: 21-40, January-February 1956.
4. DOS SANTOS, R.: Phlebographie d'une veine cava inférieure sutures. *J. urol. Paris* **39**: 586-587, 1935.
5. DUFF, P. A., AND GRANGER, W. H.: Diagnosis of Involvement of Inferior Vena Cava in Renal Neoplasms. *J. Urol.* **65**: 368-370, March 1951.
6. EDWARDS, E. A.: Clinical Anatomy of Lesser Variations of the Inferior Vena Cava and Proposal for Classifying Anomalies of This Vessel. *Angiology* **2**: 85-99, April 1951.
7. EVANS, A. T.: Combined Use of Contrast Media in Retroperitoneal Tumors. Critical Evaluation. *Arch. Surg.* **70**: 191-198, February 1955.
8. FARINAS, P. L.: Abdominal Venography. *Am. J. Roentgenol.* **58**: 599-602, November 1947.
9. FISHER, M. M., AND RITZ, N. D.: Thrombosis of the Inferior Vena Cava Due to Hypernephroma. *Arch. Int. Med.* **81**: 465-475, April 1948.
10. HELANDER, C. G., AND LINDBOM, Å.: Roentgen Examination of the Inferior Vena Cava in Retroperitoneal Expanding Processes. *Acta radiol.* **45**: 289-297, April 1956.
11. KAUFMAN, J. J., AND BURKE, D. E.: Abdominal Venography. *Am. J. Roentgenol.* **76**: 807-812, October 1956.
12. KAUFMAN, J. J., BURKE, D. E., AND GOODWIN, W. E.: Abdominal Venography in Urological Diagnosis. *J. Urol.* **75**: 160-168, January 1956.
13. KESHISHIAN, J. M., AND SPENCER, W. A.: Visualization of the Inferior Vena Cava as an Adjunct to Diagnosis of Retroperitoneal Tumors. *Ann. Surg.* **140**: 892-896, December 1954.
14. MALUF, N. S. R., AND MCCOY, C. B.: Translumbar Aortography as a Diagnostic Procedure in Urology. *Am. J. Roentgenol.* **73**: 533-573, April 1955.
15. NEWMAN, H. R., AND PINCK, B. D.: Primary Retroperitoneal Tumors. Summation of 33 Cases. *Arch. Surg.* **60**: 879-896, May 1950.
16. O'LOUGHLIN, B. J.: Roentgen Visualization of the Inferior Vena Cava. *Am. J. Roentgenol.* **58**: 617-619, November 1947.
17. O'NEIL, E. E.: Ligation of Inferior Vena Cava in Prevention and Treatment of Pulmonary Embolism. *New England J. Med.* **232**: 641-646, May 31, 1945.
18. ROBINSON, L. S.: The Collateral Circulation Following Ligation of Inferior Vena Cava; Injection Studies in Stillborn Infants. *Surgery* **25**: 329-347, March 1949.
19. SURINGTON, C. T., AND JONAS, A. F., JR.: Intra-abdominal Venography Following Inferior Vena Cava Ligation. *Arch. Surg.* **65**: 605-609, October 1952.
20. TORI, G.: [Transvertebral Phlebography of the Inferior Vena Cava (Perosseous Cavography)]. *Atti del LVI Raduno del Gruppo dei Radiologi Emiliani e Marchigiani*. Bologna, Maseggiani, 1955.
21. WOODRUFF, J. H., JR., CHALEK, C. C., OTTOMAN, R. E., AND WILK, S. P.: The Roentgen Diagnosis of Renal Neoplasms. *J. Urol.* **75**: 615-626, April 1956.

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SUMMARIO IN INTERLINGUA

Simplificate Phlebographia Del Vena Cave Inferior In Diagnoses Urologic

Un simple, salve, e rapide methodo de visualisar le vena cave inferior es presentate como auxilio del diagnose e del tractamento urologic. Post que pelliculas preliminar ha essite obtenite e post que le patiente ha essite testate pro sensibilitate a iodo, 30 cm³ de Miokon de 50 pro cento es injecte in quatro secundas via le vena femoral, durante que le patiente inspira normalmente. Un pellicula lateral, exponite al completion del injection e al culmine del inspiration, demonstra le contornos anterior e posterior del vena cave e su relation con le corpores vertebral, sin superposition del systema de collection urinari. Circa dece minutas post le prime injection, un secunde injection es effectuate e un pellicula antero-posterior es obtenite.

Isto demonstra le margines lateral del vena cave e monstra le systema de collection renal, le pelve, e le ureteres in relation a illo. Post retraction del agulia, pression es applicate, e pyelogrammas pote esser obtenite.

Le methodo es indicate in le diagnose e le localisation de primari tumores retroperitoneal e de tumores metastatic, specialmente de origine testicular; in le demonstration de ureteres retrocaval; in le diagnose de thrombosis per coagulo o tumefaction in le vena renal o le vena cave; in determinar le resultados de therapia chirurgic o radiologic; e in demonstrar anomalias del vena cave causate per le persistentia de varie partes del cardinal systema venose.

A Case of Follicular Lymphoma¹

IRVIN F. HUMMON, M.D., MARION F. MAGALOTTI, M.D., and EMANUEL R. N. GRIGG, M.D.

THE DISEASES classified under the heading of malignant lymphoma have in common erratic proliferation of lymphoid tissue and an inevitably fatal outcome. Yet, within the group, and even within any of its subgroups, there occur wide variations in the rapidity and extent of lymphoid involvement of the various organs and in the survival time after onset of the first symptoms. In some instances, the clinical course is so protracted as to warrant the wishful nomenclature of "benign lymphoma." The following case qualifies for the latter category.

G. S., white married female, born in 1909, had measles, chicken-pox, and diphtheria in childhood, but no other diseases other than occasional bouts of influenza with tonsillitis; she was neither particularly robust nor sickly. Her present illness dated back to 1946, when a "blackhead" on the left side of the neck started to grow, turned purple, and reached the size of a thumb before it was labeled "sebaceous cyst" and excised; the incision healed after six weeks of open drainage. The patient believed that the "infection" from the "cyst" descended into her left axilla, and caused the appearance of a lump, first noticed in 1947. She did not seek medical advice until 1950, when a biopsy of the left axillary node revealed "lymphoblastoma, giant follicular," and she was referred to Cook County Hospital for radiation therapy.

When first seen on Dec. 6, 1950, this frail, underweight (102 lb.), 41-year-old woman, in fair physical condition, had extensive bilateral cervical, axillary, and inguinal lymphadenopathy, but a negative chest film. She had neither fever, nor hepato- or splenomegaly. Deep roentgen therapy to the enlarged lymph nodes met with an excellent and prompt response. At the first recheck, Feb. 9, 1951, no lymph nodes could be palpated and the general condition had improved. The patient had gained weight and had no complaints.

Lymph-node enlargement recurred in the left groin on Oct. 18, 1951. This, as well as a node over the left scapula (first noticed Nov. 25, 1951), was easily controlled by local roentgen therapy (Fig. 1, Tables I and II). Another chest film taken at this time was negative. The remission lasted several months, until April 21, 1952, when a lump was palpated in

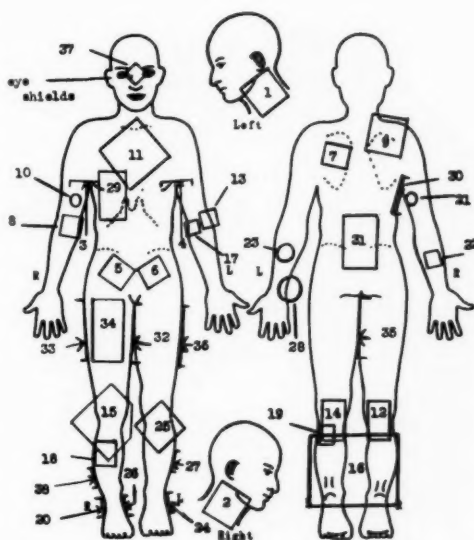


Fig. 1. Outline of treatment. The port numbers are identical with those used in Table I, which lists the dosages for each field.

the right supraclavicular area and a smaller node was noted on the medial aspect of the right arm. These receded under irradiation. On July 16, 1952, low-grade fever appeared for the first time, and the patient complained of a strange feeling over the sternum, with mild cough. Although the chest film remained negative, a short course of roentgen therapy was given over the anterior thorax, with relief of symptoms.

While the patient was at a resort area during the summer, she experienced an exacerbation, with swollen ankles and skin nodules. She returned on Aug. 25, 1952, complaining of weakness, low-grade fever, and tachycardia, which persisted for several months. Her general condition improved somewhat after radiation treatments to the affected areas. On Oct. 27, 1952, she weighed 100 lb.; on Dec. 10, her temperature had become normal, but tender nodules could be felt on the forearms. While these receded under roentgen therapy, the left knee became swollen and an effusion into the joint was diagnosed (Dec. 22, 1952); it also disappeared after irradiation.

On Feb. 26, 1953, the patient complained again of "tightness" in the chest, and at this time the roent-

¹ From the Cook County Hospital, Chicago, Ill., Department of Radiology (I. F. H., Director; M. F. Director of Therapeutic Radiology; E. R. N. G., Associate). Accepted for publication in April 1958.

TABLE I: SUMMARY OF ROENTGEN THERAPY

Port	Port Size (cm.)	Time Interval	Technic*	(r/air)	Total Dose Per Port (r/air)
1. Left cervical	10 × 10	12/6/50-1/22/51	215	1,050	1,050
2. Right cervical	10 × 10	12/6/50-1/22/51	215	1,050	1,050
3. Right axillary	10 × 10	12/8/50-1/24/51	215	1,050	1,050
4. Left axillary	10 × 10	2/15/52-2/21/52	215	1,200	2,250
5. Right inguinal	10 × 10	12/8/50-1/24/51	215	1,050	1,050
		12/11/50-1/19/51	215	900	
		1/16/53-4/2/53	215	1,220	2,120
6. Left inguinal	10 × 10	12/11/50-1/19/51	215	900	
		10/19/51-11/7/51	215	1,350	2,250
7. Left scapular	7 × 7	11/28/51-12/17/51	1A3	2,866	2,866
8. Right epitrochlear	6 × 6	12/28/51-1/9/52	1A1	1,548	1,548
9. Right supraclavicular	10 × 10	4/21/52-5/1/52	215	1,258	1,258
10. Right inner arm	5 (diam.)	4/21/52-4/28/52	1A1	1,032	1,032
11. Anterior thoracic	20 × 20	7/16/52-7/18/52	215	600	
	15 × 15	9/5/52-9/12/52	215	750	1,350
12. Right popliteal	10 × 15	8/25/52-8/29/52	1A3	670	
		9/3/52	215	200	870
13. Left epicondylar (elbow)	7 × 7	8/25/52-9/2/52	1A1	924	924
14. Left popliteal	10 × 15	8/29/52	1A4	198	
		2/20/53-2/23/53	215	500	698
15. Right knee (anteriorly)	20 × 20	9/2/52-9/12/52	215	1,150	1,150
16. Both calves	20 × 20	9/15/52-9/19/52	215	400	400
17. Left epitrochlear	5 × 5	9/19/52-10/3/52	1A3	188	
		7/12/54-7/21/54	1A2	1,400	1,588
18. Right anterior upper tibial	8 × 10	9/29/52-10/3/52	1A3	705	
		11/26/54	1A2	230	935
19. Left upper calf	6 × 8	9/29/52-10/1/52	1A3	470	470
20. Right lateral malleolar	8 × 10	10/3/52-10/27/52	215	500	
		2/9/53-2/23/53	215	1,000	
		10/6/54-10/15/54	215	600	2,100
21. Right inner arm	3 (diam.)	11/10/52-11/12/52	1A1	516	516
22. Right posterior forearm	3 × 4	12/10/52-12/15/52	1A3	585	585
23. Left posterior forearm	3 (diam.)	12/10/52-12/15/52	1A1	602	602
24. Left lateral malleolar	8 × 10	12/22/52	215	150	
		2/20/53	1A3	296	
		6/3/55	215	100	546
25. Left anterior knee	10 × 10	12/22/52	215	150	
		2/20/53	215	250	
		10/6/54-10/13/54	215	600	1,000
26. Right medial malleolar	8 × 10	1/16/53	1A1	301	301
27. Left lateral calf	8 × 10	1/30/53-2/6/53	215	600	
		5/31/55-6/14/55	1A3	939	1,449
28. Left medial wrist	5 (diam.)	2/6/53-2/9/53	1A2	580	580
29. Right anterior thoracic	10 × 15	2/26/53-3/9/53	215	1,000	1,000
30. Right lateral thoracic	10 × 15	2/27/53-3/10/53	215	1,000	1,000
31. Lumbar spine (posterior)	10 × 15	4/13/53-4/29/53	215	750	750
32. Right medial upper thigh	10 × 15	5/1/53-5/25/53	215	1,850	1,850
33. Right lateral upper thigh	10 × 15	5/6/53-5/30/53	215	2,350	2,350
34. Right anterior upper thigh	10 × 15	5/29/53	215	250	250
35. Left medial upper thigh	10 × 15	1/11/54-1/15/54	215	1,000	1,000
36. Left lateral upper thigh	10 × 15	1/18/54-1/22/54	215	1,000	1,900
37. Fronto-ethmoidal	7 × 7	9/14/54-9/20/54	215	450	
		11/15/54-11/19/54	215	375	825
38. Right lateral calf	6 × 8	11/15/54-11/19/54	215	450	
		11/26/54	1A3	296	746

* See table on Physical Data of Techniques Employed.

TABLE II: PHYSICAL DATA FOR THE TECHNIQUES EMPLOYED

Technic	kvp	ma	TSD	Filter	h.v.l.
1A1	130	8	18.5 cm.	1.0 mm. Al	3.0 mm. Al
1A2	130	8	20 cm.	1.0 mm. Al	3.0 mm. Al
1A3	130	8	25 cm.	1.0 mm. Al	3.0 mm. Al
1A1	140	8	18.5 cm.	0.25 mm. Cu + 1.0 mm. Al	0.45 mm. Cu
1A2	140	8	20 cm.	0.25 mm. Cu + 1.0 mm. Al	0.45 mm. Cu
1A3	140	8	25 cm.	0.25 mm. Cu + 1.0 mm. Al	0.45 mm. Cu
215	200	18	50 cm.	0.25 mm. Cu	1.0 mm. Cu

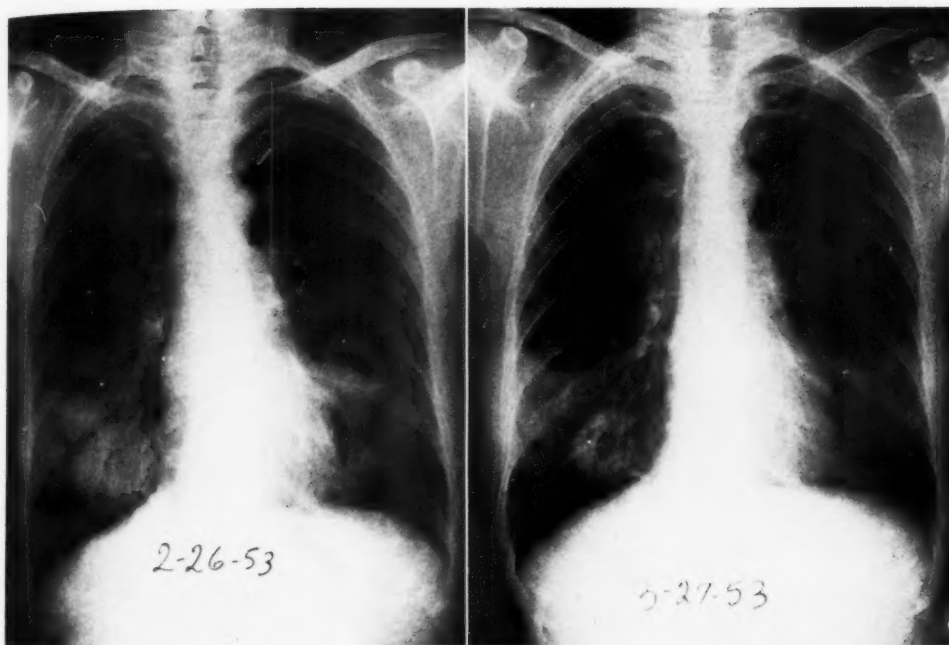


Fig. 2. Feb. 26, 1953. Subjective symptomatology (tightness in the chest) preceded the appearance of positive roentgen findings. A film taken only a few months prior to this one was essentially negative. Parenchymal infiltration is seen at both bases.

Fig. 3. March 27, 1953. Most of the complaints disappeared after a few treatments, but several months elapsed before the parenchymal infiltration faded. Considerable clearing was already apparent in one month.

genogram revealed nodular, well defined densities at the base of each lung. Radiation treatment relieved the "tight" feeling in ten days, but it was several months before the masses disappeared radiographically. (Figs. 2-4).

Beginning in January 1953, the patient complained of progressive pain in the right inguinal region, and retreatment of this area failed to bring relief. By May 1, the pain in the right upper thigh was severe, and walking was difficult. A roentgenogram of the right upper femur showed an osteolytic lesion (Fig. 5). With radiation therapy, the pain readily subsided and the bone lesion recalcified completely. In the meantime the patient gained weight; on Jan. 7, 1954, she weighed 112 lb. On Jan. 11, a severe pain over the left hip announced a symmetric bone lesion in the left upper femur, confirmed by roentgenograms. The latter lesion regressed more rapidly under irradiation than had the one on the right side.

Several local recurrences have since been noted, but with no impairment of the general health. The patient has remained entirely asymptomatic since May 1955. When she was last seen, Dec. 24, 1957, her weight was 129 lb., a gain of 29 lb. since October 1952. She had no complaints and no evidence of disease eleven years after onset.

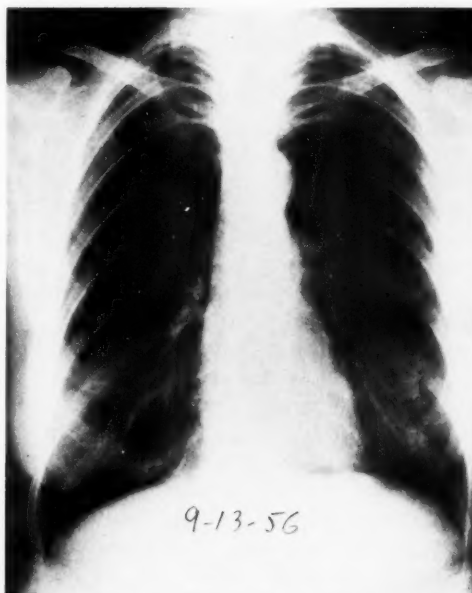


Fig. 4. Chest films remained entirely negative throughout the remainder of the observation time.



Fig. 5. Roentgenogram taken on May 21, 1953, demonstrating an osteolytic lesion at the junction of the upper and middle third of the right femur, and one taken approximately three and a half years later (Sept. 13, 1956) showing complete healing. A similar symmetrical lesion appeared in the left femur and also responded to radiation therapy.

DISCUSSION

Follicular lymphoma is a newcomer in our pathologic files. Isolated case histories, published in 1865 by Cohnheim (1) of Berlin and in 1893 by Lennander (2) of Upsala, might belong in this category, but in the absence of histologic reproductions exact identification is not possible. The first authenticated instance was communicated in 1899 by LeCount (3), a pathologist at Rush Medical School in Chicago. The second case was reported by Becker (4) of Berlin, and the third by Foix and Roemmele (5) of Paris. The first adequate clinical description was offered in 1925 by Brill *et al.* (6); and the first detailed histologic study dates back to Symmers (8).

In 1941, Gall and his associates (15) collected 63 cases from the pathologic files of the Massachusetts General Hospital in Boston. In 1954, Bilger (27) tabulated

275 cases from the medical literature, not including the 12 cases published the preceding year by Chevallier *et al.* (26). Rappaport *et al.* (29), in 1956, reviewed and correlated the histories and histologic findings of 253 cases from the records of the Armed Forces Institute of Pathology. These figures indicate that the condition is either not as uncommon as formerly believed, or that its incidence is on the increase.

Over the years, many names have been proposed for this disease: benign lymphoma (3, 20), follicular lymphoma (15, 29), giant follicular lymphoma (26), giant follicular lymphoblastoma (13, 21, 22, 24, 27), follicular lymphoblastoma (9), sarcoma lymphoides folliculare (24), follicular reticulosis (17), lymphoreticulosis (23), nodular reticulosplenoma (5), follicular splenomegaly (7), follicular hyperplastic splenomegaly (10), follicular hyper-

plastic lymphopathy (12), giant lymph follicle hyperplasia (6, 28), giant follicular lymphadenopathy (17, 18, 24), follicular lymphadenopathy (8), pseudoleukemia (1), nodular aleukemic lymphocytoma (11), Brill's disease (7, 14, 19), Symmers' disease (16), and Brill-Symmers' disease (17, 18, 24, 26, 27).

Our lack of knowledge is even better demonstrated in the need for a universally acceptable, possibly etiologic, classification of lymphomas. Formerly, most authors listed the "malignant" varieties as (i) lymphosarcoma, with its two variants, lymphoblastoma and lymphocytoma, (ii) reticulum-cell sarcoma, (iii) Hodgkin's disease, and (iv) several rare forms, such as monocytoma, plasmacytoma, pleomorphic lymphosarcoma (Symmers), Hodgkin's sarcoma (Mallory), and giant-cell reticulosarcoma (Hellwig). Opposed to this was the category of "benign" or follicular lymphoma.

Many authors have attempted to classify the lymphomas by considering the predominant cellular component, which has often necessitated the inclusion of leukemias (11), certainly a complicating feature. More recently, Berman (25), by evaluating the amount of stroma and/or cellular elements, grouped the lymphomas as "pure" types—(i) reticulum cell, (ii) lymphoblastic, and (iii) lymphocytic—and "mixed"—(iv) Hodgkin type and (v) follicular type, the latter with two stages, preblastomoid and progression to a diffuse form.

Berman's classification was modified by Rappaport *et al.* (29), who emphasized that there are no benign lymphomas. A study of the cellular composition will permit inclusion of any lymphoma, be it follicular or diffuse, into one of five integrated groups: (i) lymphocytic type, well differentiated, (ii) lymphocytic type, poorly differentiated, (iii) mixed type (lymphocytic and reticulum-cell), (iv) reticulum-cell type, and (v) Hodgkin type. The follicular (nodular) pattern is regarded as a stage which often, but not necessarily, progresses into the irreversible diffuse

pattern. The original cellular composition is usually preserved even with change of pattern to the diffuse stage.

Early authors used the terms benign or giant follicle hyperplasia with the intention of creating a link between reactive (inflammatory) lymphadenopathy and the lymphomas. However appealing, and even theoretically acceptable, such a pathogenetic relationship has never been conclusively demonstrated. In fact, a "reactive" (hyperplastic) follicle and a "lymphomatous" (neoplastic) follicle-shaped conglomeration of malignant cells are just as dissimilar as are a gland and an adenocarcinoma. The histologic dividing line between lymphatic hyperplasia and lymphoid neoplasia is often difficult to determine, particularly when the reactive hyperplasia is associated with marked numerical and dimensional increase in follicles. Differential features have been described for microscopic diagnosis (29). Just as in any other neoplastic process, better differentiation and preservation of normal architecture, in this case a follicular pattern, is associated with longer survival, while transition to a diffuse pattern indicates the approach of the terminal episode.

The slides of the case herein reported, prepared from the axillary lymph node removed in 1950, were reviewed in 1956 in the Department of Clinical Pathology. The diagnostic impression was follicular lymphoma, but the excessive cellularity and the invasion by lymphoid elements of the perinodular fat tissue would have been interpreted only a few years ago as an early indication of impending transition to lymphosarcoma. The examiner, who knew of the protracted clinical course, specified that this description was based strictly on the microscopic appearance. One is thus led to believe that transcapsular lymphoid invasion is not incompatible with the follicular stage of lymphoma.

The only differences between follicular lymphoma and diffuse lymphoma are the histologic appearance and the protracted clinical course (five years and longer for follicular lymphoma, compared with eight

to eighteen months for lymphosarcoma, and two to three years for untreated Hodgkin's disease). There is otherwise much similarity in the involvement of lymphoid tissue outside of the lymph nodes proper, *i.e.*, in such organs as the spleen, liver, lungs, bones, and gastrointestinal tract. Even the roentgenologic features of pulmonary and osseous lesions are very much the same in all the types of lymphoma. There are no rules for the order or the extent of involvement of the different organs. In addition to extensive adenopathy, our patient had cutaneous, osseous, articular, and pulmonary lesions. Highly unusual is the absence, thus far, of abdominal localization (spleen, liver, or bowel), considering that splenomegaly has often been described as a common feature of follicular lymphoma.

While all the lymphomas are radiosensitive, they are especially so in the follicular stage (18, 21, 23). External roentgen therapy is the method of choice and, when applied judiciously, will result in symptomatic relief. We believe it can also prolong the survival time. Our patient at least on two occasions was on a definitely downhill course. A spontaneous biological reversal cannot be entirely ruled out on theoretical grounds, but the time intervals and other considerations are highly suggestive of a cause-effect relationship between the roentgen therapy and the local and general improvement.

General mitotic depressants, such as nitrogen mustard, were not considered in this case. The majority of the foci of activity were easily accessible and promptly responded to external irradiation. Of the thirty-eight ports used, twenty-five were located in the extremities. These multiple ports were accumulated over a period of four years. Although six ports were required in the first two months, subsequently only one or two areas of activity were presented at a time. The above reasons, together with the apparent sparing of the abdominal viscera, influenced us in deciding against the use of nitrogen mustard or any similar medication.

At the time of writing, more than three years after the last application of roentgen therapy, the patient is asymptomatic and there is neither clinical nor roentgenological evidence of lymphoma in any location. The large number of irradiated ports did not seem to have affected hematopoiesis, since the blood count remains within average limits. Even though the final outcome may prove to be less favorable, our goal—palliation with long-term survival—has already been achieved to a significant extent.

SUMMARY

A case of follicular lymphoma in a middle-aged female has been presented, together with a brief review of the literature. The patient received external roentgen therapy between 1950 and 1955 and has remained asymptomatic and clinically free of lymphoma. Although 38 ports have been irradiated, there is no evidence of damage to the blood-forming organs.

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REFERENCES

1. COHNHEIM, J.: Ein Fall von Pseudoleukämie. *Virchows Arch. f. path. Anat.* **33**: 451-454, 1865.
2. LENNANDER, K. G.: Ett fall af mjeltextirpation. *Upsala läkaref. förh.* **28**: 397-409, 1893.
3. LECOUNT, E. R.: Lymphoma, a Benign Tumor Representing a Lymph Gland in Structure. *J. Exper. Med.* **4**: 559-567, 1899.
4. BECKER, E.: Ein Beitrag zur Lehre von den Lymphomen. *Deutsche med. Wchnschr.* **27**: 726-728, 750-752, Oct. 17 and 24, 1901.
5. FOIX, C., AND ROEMMELE, A.: Contribution à l'étude du sarcoma primitif de la rate à propos d'une forme spéciale, le réticulosplénome secondaire. *Arch. de méd. expér. et d'anat. path.* **24**: 111-160, 1912.
6. BRILL, N. E., BAEHR, G., AND ROSENTHAL, N.: Generalized Giant Lymph Follicle Hyperplasia of Lymph Nodes and Spleen. *J.A.M.A.* **84**: 668-671, Feb. 28, 1925.
7. IKEDA, K.: Follicular Splenomegaly. Brill's Type? *Arch. Path.* **1**: 658-661, April 1926.
8. SYMMERS, D.: Follicular Lymphadenopathy with Splenomegaly; a Newly Recognized Disease of the Lymphatic System. *Arch. Path.* **3**: 816-820, May 1927.
9. BAEHR, G.: The Clinical and Pathological Picture of Follicular Lymphoblastoma. *Tr. A. Am. Physicians* **47**: 330-338, 1932.
10. FERRATA, A., AND INTROZZI, P.: Splenomegalia primitiva folliculo-iperplastica. Splenectomy. *Guarigione. Hematologica* **14**: 159-171, 1933.

11. CALLENDER, G. R.: Tumors and Tumor-like Conditions of the Lymphocyte, the Myelocyte, the Erythrocyte, and the Reticulum Cell. *Am. J. Path.* 10: 443-466, July 1934.
12. FIESCHI, A.: Linfopatia follicolo-iperplastica. *Haematologica* 19: 145-169, 1938.
13. WU, S. D.: Giant Follicle Lymphoblastoma; Report of Case and Review of Literature. *Chinese M. J. suppl.* 3: 1-25, March 1940.
14. NICHOL, J. E.: Case of Brill's Disease. *Canad. M. A. J.* 43: 151-153, August 1941.
15. GALL, E. A., MORRISON, H. R., AND SCOTT, A. T.: The Follicular Type of Malignant Lymphoma; Survey of 63 Cases. *Ann. Int. Med.* 14: 2073-2090, May 1941.
16. BRUCK, E.: Fall av Symmers' sjukdom. *Nord. med.* 17: 505-508, 1943.
17. HEINTZELMANN, F.: Giant Follicle Lymphadenopathy (Follicular Reticulosis—Brill-Symmers' Disease). *Acta med. scandinav.* 124: 359-378, 1946.
18. UHLMANN, E. M.: The Significance of Giant Follicular Lymphadenopathy (Brill-Symmers Disease). *Radiology* 50: 147-156, February 1948.
19. HANNEMA, L. S.: De ziekte van Brill. *Nederl. tijdschr. geneesk.* 92: 2732-2735, Sept. 4, 1948.
20. DUPERRAT, B.: Les lymphomes bénins du rectum. *Presse méd.* 58: 1149-1150, Oct. 18, 1950.
21. COCCHI, U., AND MEIER, E.: Zur Frage der Therapie des grossfollikulären Lymphoblastoma. *Oncologia* 3: 1-26, 1950.
22. RITAMA, V.: Giant Follicular Lymphoblastoma. *Ann. med. int. Fenniae* 40: 162-185, 1951.
23. TOD, M. C.: The Reticuloses and Lymphoreticular Sarcomas From the Radiotherapist's Point of View. *Edinburgh M. J.* 59: 457-477, October 1952.
24. CANDREVIOTIS, N.: Histologische Untersuchungen über das Wesen des grossfollikulären Lymphoblastomas: Sarcoma lymphoides folliculare, Brill-Symmerssche Krankheit. *Deutsche med. Wchnschr.* 77: 1115-1116, Sept. 12, 1952.
25. BERMAN, L.: Malignant Lymphomas; Their Classification and Relation to Leukemia. *Blood* 8: 195-210, March 1953.
26. CHEVALLIER, P., BERNARD, J., BILSKI-PASQUIER, G., AND CHRISTOL, D.: Sur 12 cas de lymphome giganto-folliculaire (maladie de Brill-Symmers). *Sang* 24: 665-699, 1953.
27. BILGER, R.: Das gross-follikuläre Lymphoblastom (die Brill-Symmerssche Krankheit). *Ergebn. inn. Med. u. Kinderh.* 5: 642-706, 1954.
28. EVANS, T. N., AND DOAN, C. A.: Giant Follicle Hyperplasia; a Study of Its Incidence, Histopathologic Variability, and the Frequency of Sarcoma and Secondary Hypersplenic Complications. *Ann. Int. Med.* 40: 851-880, May 1954.
29. RAPPAPORT, H., WINTER, W. J., AND HICKS, E. B.: Follicular Lymphoma. A Re-evaluation of Its Position in the Scheme of Malignant Lymphoma, Based on a Survey of 253 Cases. *Cancer* 9: 792-821, July-August 1956.

SUMMARIO IN INTERLINGUA

Un Caso De Lymphoma Follicular

Es reportate un caso de lymphoma follicular in un femina de etate medie. Un breve revista del litteratura relative a iste condition es presentate. Le patiente esseva tractate per roentgeno-irradiation inter 1950 e 1955. Al fin de 1957, illa

esseva asymptomatic e clinicamente libere de morbo, dece-un annos post su prime symptomas. Ben que 38 portos esseva irradiate, nulle insulto al organos de hematopoiese esseva apparente. Il pare que le viscères abdominal non esseva afficite.



Prognosis in Osteitis Condensans Ilii¹

JOSEPH K. ISLEY, JR., M.D., and GEORGE J. BAYLIN, M.D.

THE ENTITY OF osteitis condensans ilii is first mentioned in the English literature in 1936 (1). Since that time there have been several good reviews of the subject (2, 3). It has been impossible however, to settle upon a definite etiology or constant clinical picture. The few aspects which seem to be relatively established are the radiological picture, the age and sex incidence, and the pathological picture. The purpose of this paper is to contribute some clarifying information regarding the prognosis.

Nineteen cases of osteitis condensans ilii seen at Duke University Medical Center, in the years 1940 to 1958, were obtained from the x-ray museum file. These did not represent all of the cases seen during the period but only those cases placed in the teaching collection because of their roentgen appearance.

The radiological criteria for diagnosis were: (a) the presence of a homogeneous triangular area of increased density involving the ilium adjacent to the sacroiliac joint and located at the lower border of the articulating surface of the ilium, (b) normal appearing sacroiliac articulating surfaces and joint space; (c) little or no radiologic evidence of involvement of the sacrum; (d) minimal or no spurring at the lower margin of the sacroiliac joint.

Nine of this series of 19 patients whose last admission dated back twelve months or more have been followed up. These patients were interviewed and examined, and repeat roentgen studies were obtained. An attempt was made in each case to duplicate the technic of the previous x-ray examination.

Caution must be used in distinguishing osteitis condensans ilii from several other diseases. Probably the condition most

resembling it is hypertrophic arthritis of the sacroiliac joint. Here, however, the area of condensation is usually much smaller and is located at the most caudad portion of the sacroiliac joint. The joint space may be narrowed and the typical finding of eburnation with spurring is present. The process also involves the sacrum and it does not improve with time. One should look for a history of injury or other skeletal abnormalities to support this diagnosis.

Marie-Strümpell arthritis may also offer somewhat of a problem both clinically and radiologically. In Marie-Strümpell arthritis the joint space should show signs of involvement, with irregularities and loss of definition. There should be evidence of sacral involvement and the area of increased density should parallel the articulating surfaces of the sacrum and ilium rather than being of a triangular pattern. The area of increased density is irregular and splotchy with poorly defined limitations, not the clearly defined homogeneous density of osteitis.

Other conditions which might be mistaken for osteitis condensans are metastatic tumors, Paget's disease, osteomyelitis, and syphilis.

RESULTS

The findings for the total series of 19 cases are presented in Table I. The results of follow-up are listed in Table II.

DISCUSSION

The purpose of this report is to point out that the condition of osteitis condensans ilii is not a static one, either from the clinical or the roentgenologic aspect. It is recognized that this series of 9 cases with long-term follow-up is not large. We feel, however, that the high percentage

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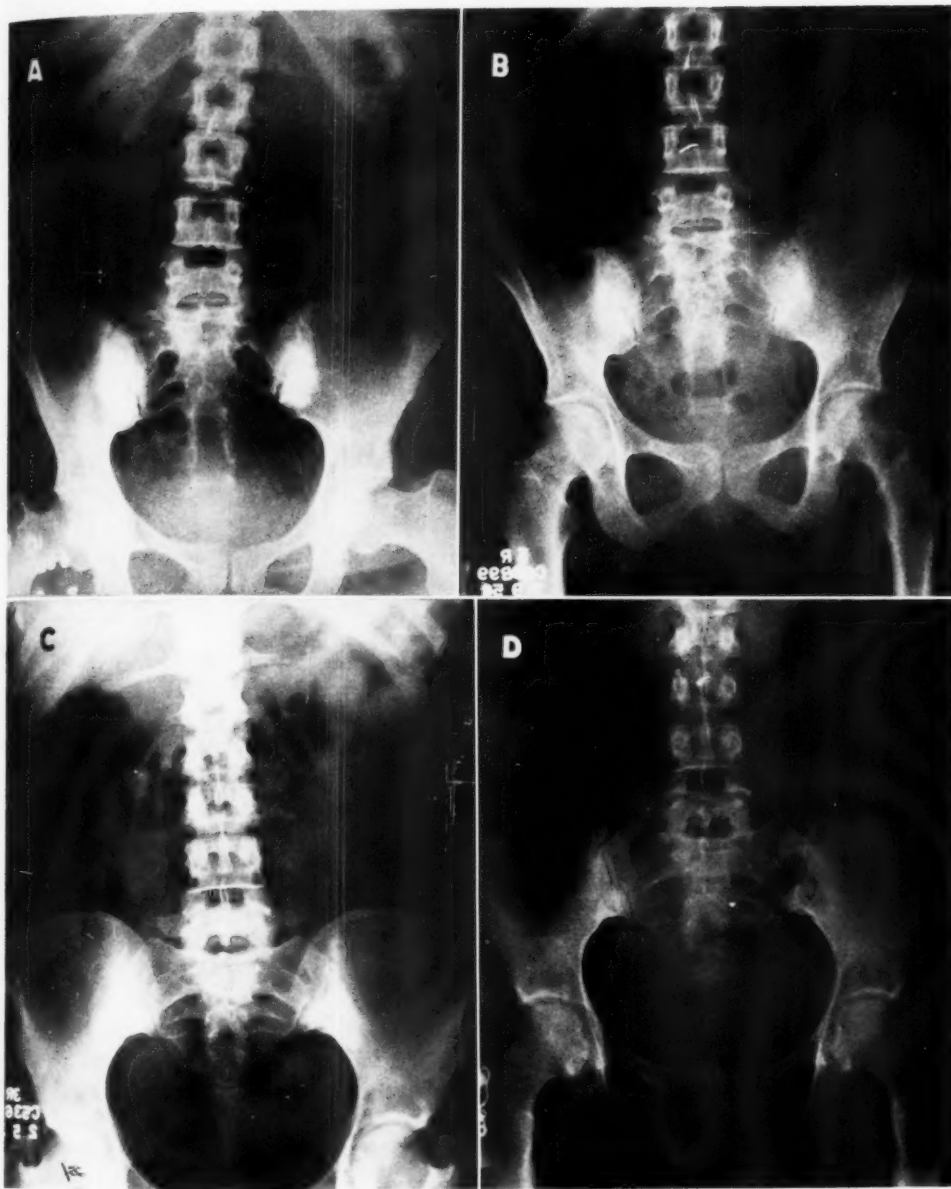


Fig. 1. Osteitis condensans ilii. A and B. Case O. W., showing 70 per cent clearing in fifty-three months. C and D. Case F. W., showing 90 per cent clearing in one hundred and one months.

of patients showing an improvement in the radiological picture make it significant. All but 2 showed definite signs of improvement, though 1 of these actually showed an increase in the area involved and degree of density. This patient at the time of the

last examination was twenty-nine years of age and had 11 children, the youngest four months old. She had experienced no change in the severity or type of back pain in about eight years. The possible relationship of the numerous pregnancies



Fig. 2. Marie-Strümpell arthritis in a thirty-three-year-old female.

to osteitis condensans ilii in this instance is a subject for speculation, but we do not feel that this lies within the scope or intent of the present discussion.

It might also be pointed out that, of this total series, 5 had genitourinary tract

TABLE I: OBSERVATIONS ON 19 CASES OF OSTEITIS CONDENSANS ILII

Total number of cases	19 (female 18; male 1)
Average age	35.3 years (range 21 to 50 years)
Involvement	Unilateral 2; Bilateral 17
Back pain	Present 13; Absent 6
Neurological changes	Present 1; Absent 18
Tenderness of sacroiliac joint	Present 6; Absent 13
Straight leg raising	Positive 4; Negative 15
Genitourinary disturbance	Present 5; Absent 14
Prior pregnancy	Yes 13; No 6
X-ray therapy	Yes 3; No 16

TABLE II: OBSERVATIONS ON NINE CASES OF OSTEITIS CONDENSANS ILII FOLLOWED FOR THREE TO THIRTEEN YEARS

Patient	Age at First Examination	Interval (Months)	Change	Neurologic Changes	Sacroiliac Tenderness	—Back Pain— Past Present	History of Injury	Previous Pregnancy
CRM	38	54	20% clear	0	0	+	0	0
MLH	35	108	70% clear	0	0	+	+	8 yr.
ABH	30	156	100% clear	0	0	0	0	0
FW	44	101	90% clear	0	0	0	0	11 yr.
CT	41	145	0% clear	0	0	0	0	1 yr.
BP	26	35	20% increase	0	0	+	+	4 mo.
OW	34	53	70% clear	0	0	0	0	4 yr.
JI	28	42	50% clear	0	+	+	0	5 mo.
NM	50	108	25% clear	0	0	0	0	20 yr.

complaints, 13 had been pregnant, and 2 showed unilateral involvement. There was 1 male in this series. Most of the patients in the series complaining of back pains experienced discomfort of a somewhat episodic type which spontaneously disappeared after a few days to weeks.

Of the follow-up series of 9 cases there were none who received x-ray therapy for back pain; yet there was a high percentage of regression. One patient had a condensing process in the symphysis pubis. This lesion became more marked as the osteitis condensans ilii became less distinct. This we cannot explain.

It is of interest that there are no patients in this series over fifty years of age, though a large portion of admissions to this institution, as well as other institutions, is made up of the older age group. This agrees with the concept of eventual spontaneous clearing in a considerable proportion of cases.

These findings must be taken into consideration in the evaluation of reports of relief of this condition by treatment of whatever type. With the undesirability of irradiating the pelvis in a female of child-bearing age, they seem to cast serious doubt on the advisability of roentgen irradiation as a means of treatment.

SUMMARY

A series of cases of osteitis condensans ilii is presented in which the diagnosis was made on the basis of radiological findings alone. A group of these cases

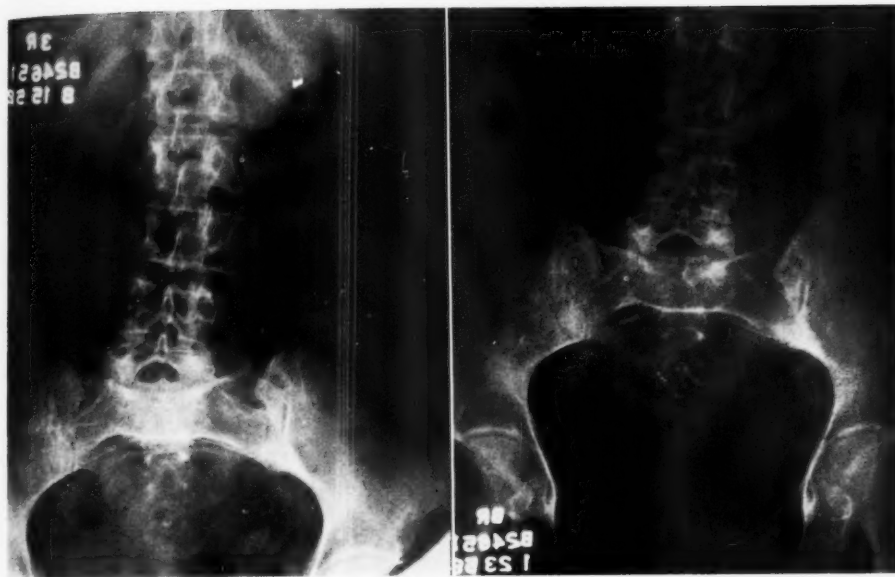


Fig. 3. Hypertrophic arthritis in a forty-two-year-old female.

were re-evaluated after a period ranging from three to thirteen years. A high percentage were found to show improvement of varying degrees clinically and regression of the areas of condensation radiologically.

These findings suggest that osteitis condensans ilii is a benign, self-limited disease which undergoes spontaneous regression over a period of months to years.

REFERENCES

1. RENDICH, R. A., AND SHAPIRO, A. V.: Osteitis Condensans Ilii. *J. Bone & Joint Surg.* **18**: 899-908, October 1936.
2. WELLS, J.: Osteitis Condensans Ilii. *Am. J. Roentgenol.* **76**: 1141-1143, December 1956.
3. GILLESPIE, H. W., AND LLOYD-ROBERTS, G.: Osteitis Condensans. *Brit. J. Radiol.* **26**: 16-21, January 1953.

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SUMMARIO IN INTERLINGUA

Prognose In Condensante Osteitis Iliac

Es presentate un serie de casos de condensante osteitis iliac in que le diagnose esseva facite exclusivemente super le base del constatationes radiologic. Un gruppo de 9 del patientes esseva re-evalutate post periodos de inter tres e dece-tres annos. Esseva trovate que septe monstrava melioration de varie grados ab le puncto de

vista clinic e regression del areas de condensation ab le puncto de vista radiologic.

Iste observationes suggere que condensante osteitis iliac es un benigne morbo de character auto-limitatori que manifesta un regression spontanee post un periodo de menses o de annos.

Attempted Opacification of the Pancreas with the Use of Iodinated Dyes

THOMAS T. WHITE, M.D., and D. F. MAGEE, M.A., B.M., Ph.D.

THE RECENT report by Robert Shapiro (3), of experimental opacification of the pancreas in the rabbit by intravenous injection of a contrast material, has prompted an account of some previous experiments of a similar nature. Approximately three years ago a study was initiated in which attempts were made to opacify the pancreas in the dog following intravenous injection of iodinated dyes.

Our initial studies were undertaken following the report of Ingraham and Visscher (1) on the excretion of aniline and other dyes from the pancreatic duct of dogs. They found that within two or three hours of injection the external secretion of the pancreas might contain as much as 5 per cent of the blood concentration of some of these dyes. Wool blue G, fast fuchsin B, rhodamine B, acridine red, indigo carmine, eosin BS, basic fuchsin, fluorescein, and methyl red were excreted from the pancreatic duct in amounts varying from 0.5 to 5 per cent of the blood concentration within a very short period.

For our first attempts to duplicate some of these experiments, rabbits were used. The duodenum was triply ligated, immediately above the pancreatic duct, about 8 cm. above the first ligature, and about 8 cm. below it, under chloralose anesthesia. The dyes were injected intravenously. After two hours the animals were reopened and the contents of the two duodenal segments, the stomach, and the urine were examined (Table I). Since rhodamine B, acridine red, basic fuchsin, acridine orange, pyronin B, and neutral red appeared in the loop into which the duct opened, it was decided to study the actions of these substances in the dog.

The first experiments were done on dogs with either acute or chronic pancreatic fistulas. Since neutral red had been thought by one of our co-workers to localize in the mitochondria of the pancreatic acinar tissue, and was clearly seen in the mouse pancreas, this was given first, but was found not to appear in the fistulas. Furthermore, simple iodination of the dye prevented its uptake by acinar cells even in the mouse. Basic fuchsin did not appear, while rhodamine B was seen in small concentration, and acridine red was present in the fistula catheters in a highly concentrated form almost immediately after its intravenous injection. Simple iodination of acridine red markedly lessened its solubility, but it still appeared promptly in the catheters (Table I).

An area of opacity was frequently observed in intact animals in the vicinity of the pancreas. This, however, was not actually within the pancreas, as indicated when metal clips were placed around its border, but was thought rather to be within the duodenum or stomach (Figs. 1 and 2). Similar results were obtained with a 4-iodinated compound (gravimetric analysis only) of acridine orange. Experiments with methyl iodide derivatives of both dyes were difficult because of their extreme insolubility, and no results were obtained. Attempts were made to suspend the dye alone with Tween 20, etc. Fifteen cubic centimeters of propylene glycol and 5 c.c. 95 per cent ethyl alcohol were used in an attempt to dissolve the iodinated dye, but not too successfully from point of view either of solubility or of toxicity. In no case did dye, either free or iodinated, appear in the pancreatic fistula if it had been injected as a suspension rather than in solution.

¹ From the Departments of Surgery and Pharmacology, University of Washington School of Medicine, Seattle, Wash. (T. T. W., Clinical Assistant Professor of Surgery; D. F. M., Associate Professor of Pharmacology). Accepted for publication in April 1958.



Fig. 1. Opacity following injection of iodinated acridine red.

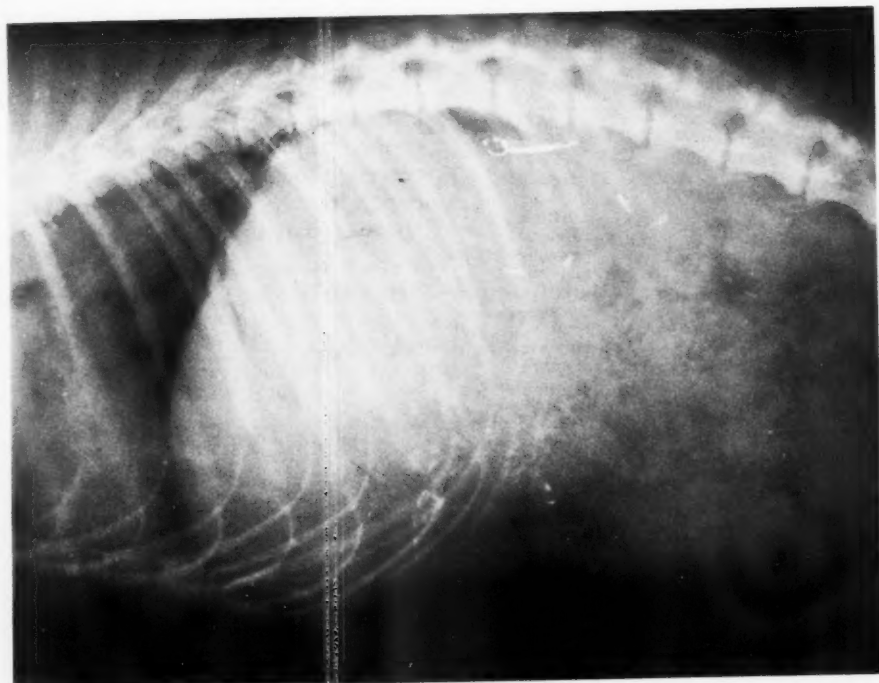


Fig. 2. Same animal as in Figure 1, with clips inserted to outline the pancreas. The area of opacity is seen to lie outside the pancreas itself.

TABLE I: RESULTS OF EXPERIMENTS WITH IODINATED DYES

Animals Used	Dye	Results
3 dogs (10-15 kg.) with pancreatic fistulas	50 mg. rhodamine B solution, intravenously	Small secretion of dye through fistulas in one dog
3 dogs (14 kg.) with chronic fistulas	90 c.c. saturated solution acridine red	Dye immediately appeared in fistula catheter
1 dog (8 kg.) with Thiry-Vella loop of duodenum (3rd part)	40 c.c. saturated solution acridine red	Dye appeared in loop
1 dog (10 kg.) with chronic fistula	10 mg. iodinated (4I) acridine red solution	No opacity; dye appeared promptly in catheter
3 intact dogs	100 mg. iodinated (4I) acridine red solution	Questionable opacification of duodenum
1 intact dog with clips	100 mg. iodinated (4I) acridine red suspension	Immediate scratching; no opacities; question of sublimation
1 intact dog	100 mg. acridine red methyl iodide solution	Dog died in ten minutes; possible dye in duodenum
1 intact dog	100 mg. acridine red methyl iodide in propylene-glycol-alcohol mixture	Questionable duodenal opacity
1 intact dog	275 mg. 4-iodine acridine orange solution	Possible visualization of duodenum
1 intact dog	200 mg. 4-iodine acridine orange suspension	Dog died immediately
Rabbit 4	10 mg. rhodamine B solution	Marked excretion through pancreatic duct. Moderate amount in stomach
Rabbit 5	25 mg. acridine red solution	Marked excretion through pancreatic duct and bladder; dye in stomach
Rabbit 13	30 c.c. saturated solution basic fuchsin	Marked excretion through pancreatic duct; no dye in stomach or bladder
Rabbit 31	60 mg. acridine orange solution	Marked excretion through pancreatic duct and bladder; no dye in stomach
Rabbit 32	60 mg. pyronin B solution	Moderate excretion through pancreatic duct, none by other routes

Nardi and Seipel (2) have reported that extracts of Colombo root localize largely in the rat pancreas after intravenous injection, berberine being thought to be the most satisfactory of the several derivatives used. Our efforts to localize this compound failed in 2 dogs, with no fluorescence visible in the pancreas of either.

DISCUSSION AND CONCLUSIONS

In regard to halogen toxicity, we agree with Shapiro that the 4-atom-iodinated organic compounds, particularly those of pyronin B, are highly toxic to dogs. We also agree that the halogen dyes which we have used are extremely insoluble and, therefore, unsuitable for injection intravenously into animals. Heavy metal toxicity we have not encountered. It is true that opacity in some instances can be obtained in the upper portion of the abdomen but unless definite localization of the pancreas, as demonstrated with the aid of metallic clips placed about its edges, we do not feel that we can say that the pancreas itself has been visualized. Our pictures are very similar to those of Shapiro but we do not regard them as evidence of opacification of the pancreas; rather they represent opacification of the gut in the region of the pancreas. This in itself, however, may be useful.

Note: The authors acknowledge with gratitude the assistance of Dr. T. Lloyd Fletcher, who effected the iodination of the dyes used.

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REFERENCES

1. INGRAHAM, R. C., AND VISSCHER, M. B.: Studies on the Elimination of Dyes in the Gastric and Pancreatic Secretions, and Inferences Therefrom Concerning the Mechanisms of Secretion of Acid and Base. *J. Gen. Physiol.* **18**: 695-716, May 1935.
2. NARDI, G. L., AND SEIPEL, J. H.: The Selective Localization of Alkaloids in Pancreatic Tissue. *Surg. Forum* **6**: 381-385, 1956.
3. SHAPIRO, R.: Experimental Opacification of the Pancreas. A Preliminary Report. *Radiology* **69**: 690-692, November 1957.

SUMMARIO IN INTERLINGUA

Essayo De Opacificar Le Pancreas Per Medio De Iodate Colorantes

Canes e conilios esseva subijcite a injectiones intravenose de colorantes de anilina e de altere colorantes in le spero de effectuar un opacification del pancreas. In certe casos, un area de opacitate esseva de facto visibile in le portion superior del abdomine ubi nulle tal habeva essite

visibile ante le injection. Tamen, quando crampas metallic esseva affixate circa le margines del pancreas, il se monstrava que le area de opacitate non esseva intra le pancreas mesme. In le opinion del autores illo representa plus tosto un opacification de intestino in le region del pancreas.



The Stanford Medical Linear Accelerator

II. Installation and Physical Measurements¹

M. WEISSBLUTH, Ph.D., C. J. KARZMARK, Ph.D., R. E. STEELE, Ph.D., and A. H. SELBY, B.S.

THE ELECTRON LINEAR accelerator is an instrument for the acceleration of electrons to high energies by means of guided electromagnetic waves. It may serve as a source of both energetic electrons and x-rays, the latter being obtained by bremsstrahlung conversion in materials of high atomic number. Both types of radiation are of interest in the field of cancer therapy. Although very high energies have been achieved with linear accelerators (1) to serve the purposes of investigations in nuclear physics, moderate energies are sufficient for medical purposes. Thus, for x-ray work all the advantages of supervoltage therapy may be realized in the energy range of 3-10 MEV, while techniques which make use of direct electron irradiation require energies up to about 30 MEV.

On the basis of such considerations, the Stanford medical accelerator was designed to operate at 6 MEV. At this energy, it serves primarily as a source of supervoltage x-rays, and secondarily as a source of low-energy electrons which may be employed in the treatment of superficial skin lesions. The electron applications are currently under development and will not be discussed in this report. Various technical considerations which influenced the final design of this accelerator are described by Ginzton, Mallory, and Kaplan (2).

The machine was completed in 1955 and installed at Stanford Hospital. The treatment of patients began in early 1956. It has been customary to operate the accelerator at an energy between 4 and 5 MEV. At 4.2 MEV, the forward intensity of the x-ray beam is 0.38 milliwatts/sq. cm. (corresponding to 65 rads/min. at the maximum of the transition curve in water)

for an average electron current of 16 microamperes at the target. Under these conditions, the corresponding x-ray dose distributions are similar to those described by Greene and Tranter (3) and by Murison and Hughes (4). Magnetic analysis of the electron beam indicated that satisfactory operation is obtainable in the range of 2 to 5.5 MEV.

Linear accelerators must be operated under pulsed conditions. In the present design, the electron beam is incident on the target in bursts of approximately one microsecond duration, repeated 480 times per second. Thus, the x-ray intensity during the pulse is about 2,000 times higher than the average intensity.

This report is intended as a description of the physical characteristics of the machine and the relevant instrumentation and techniques that have evolved. What is described here is not to be interpreted as optimum in any sense but rather as a step toward the development of a useful tool in radiation therapy.

THE ACCELERATOR

Since descriptions of the physical and electrical characteristics of linear electron accelerators have already been given (1, 2), only those features which are pertinent to radiotherapeutic applications will be described. The accelerator consists of (a) a gun, the function of which is to produce a pulsed beam of electrons of about 100 kev energy and about 50 microamperes average current; (b) an accelerating section in which the electron energy is increased from 100 kev to the final energy; (c) a transmission target assembly to convert a portion of the electron energy to x-rays; (d) a defining unit which colli-

¹ From the Department of Radiology, Stanford University, San Francisco, Calif. The work reported here has been supported by the American Cancer Society, the United States Public Health Service, and the United States Navy (Office of Naval Research). Presented in part at the Forty-second Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2-7, 1956. Received for publication in June 1958.

mates the x-ray beam and contains other auxiliary apparatus.

The electrons, after reaching the end of the accelerator tube, emerge through a titanium window² (0.0075 in. thick) and, after traversing a short air path of about 1.8 in., impinge upon a target of gold, 0.020 in. thick (equivalent to 0.16 radiation lengths), in which x-rays are produced. The gold target is removable, and the electrons may be allowed to come directly out for the purpose of electron irradiation.

The initial version of the target assembly was designed to hold the x-ray target in place, act as an electron beam monitor, and filter the low-energy component of the x-ray spectrum. Thus, the gold transmission target was followed by an insulated carbon block which was connected to ground through a microammeter. For an average gun-emission current of 40 microamperes, the average beam current emerging from the end of the accelerator was 16 microamperes. Approximately one-third of the beam current penetrated the target and was collected by the carbon block. In this arrangement, filtration of the x-ray beam was accomplished by (a) the target, 0.020 in. gold, (b) beam collector, 0.64 in. carbon, and (c) holder, 0.04 in. brass. Beyond the target assembly, additional filtration was provided by an aluminum mirror: 0.031 in. thick. The beam monitor (insulated carbon block) subsequently proved not to be particularly useful. The target assembly was therefore simplified to an aluminum holder, 3/8 in. thick in the direction of the x-ray beam, to which the gold target was attached.

The x-ray beam, upon emerging from the target-filter assembly, passes through the defining unit shown in Figure 1. This defining unit, in addition to providing shielding near the point of origin of the x-ray beam, contains the following items: a set of movable lead jaws (H) with which

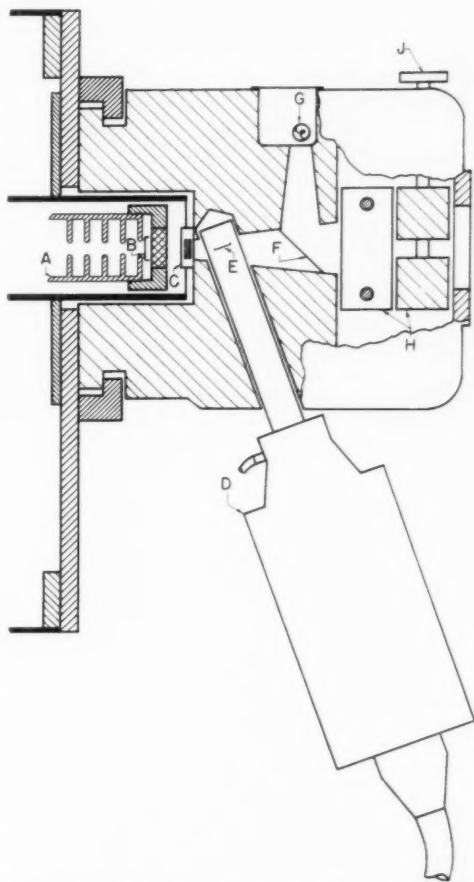


Fig. 1. The defining unit, showing the end of the accelerator (A), output window and target assembly (B), monitor chamber (C), housing of retractable radiographic x-ray tube (D), target of radiographic x-ray tube (E), inclined mirror (F), and light source (G) of light localizer, adjustable lead jaws (H), and field-size adjustment knob (J).

the field size at the patient is adjusted; a light localizer (F, G) which provides for optical simulation of the x-ray beam, thereby aiding in the alignment of the patient; a monitor ionization chamber (C) for dosimetric purposes; a retractable 150-kv x-ray tube (D, E). The first two items are self-explanatory, and the third (monitor ionization chamber) will be described in the next section.

A recurrent question in radiation therapy with external beams is the accuracy with which the patient has been aligned relative to the beam. Various aids have been

² Early experience with electron windows made of nickel (0.002 in. thick) indicated that nickel is subject to corrosion and eventually punctures under our operating conditions. The titanium windows have proved satisfactory.

devised, including the above-mentioned light localizer. These have the common disadvantage that reference is made to skin markings, whereas the region to be treated is usually internal. Radiographs taken with the accelerator did not contain sufficient easily recognizable detail for good patient alignment. Although it cannot be said that all the possibilities of this technic have been exhausted, it is nevertheless recognized that high-energy x-ray beams, by the nature of the absorption process, cannot exhibit good contrast between bone and tissue. Where there may

graphic tube in position and the lead jaws of the defining unit opened to a field much larger than the treatment field, a radiograph is obtained. Without moving the film or patient, the radiographic tube is retracted, the jaws are closed down to the correct treatment field, and a short exposure is made with the accelerator beam. The film when developed shows the position of the accelerator beam superposed on a radiograph of the region of interest. Figure 3 illustrates this technic: *A* is a radiograph of a skull taken with the Philips tube; the circle and cross are right

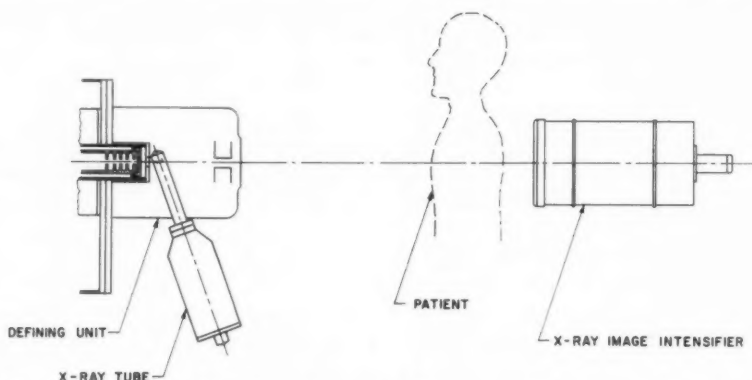


Fig. 2. Diagram showing patient alignment by fluoroscopy. The x-ray tube is retracted when the accelerator beam is on.

be air pockets in the path of the beam, good contrast may be achieved. Since the linear accelerator is, at best, a limited radiographic tool, an auxiliary diagnostic x-ray tube (Philips MG 150) was incorporated in the defining unit. The tube is shown in Figure 1. It is mounted so that it may be put in position to produce a beam of x-rays (up to 150 kvp) whose central axis coincides with the central axis of the accelerator beam. When in position, the x-ray tube provides a variable-quality beam for radiographic work. Together with an x-ray image intensifier, internal anatomical landmarks may be employed to aid in the alignment. This technic is illustrated in Figure 2.

Finally, a permanent record of the alignment is obtained on film. This is accomplished as follows: with the radio-

graph and left lead markers. In *B* the accelerator beam has been added. Alignment with the aid of the auxiliary x-ray tube has proved to be accurate and informative; clinical applications are described by Kaplan and Bagshaw (5).

DOSIMETRY

A. Introduction: Dosimetric measurements are designed to provide the therapist with information regarding the absorbed dose within that region of the patient receiving radiation. For obvious reasons, such measurements are usually made in tissue-equivalent media (phantoms) such as Masonite, water, Lucite, etc. An important question here is the degree of relevance of such measurements to the actual treatment situation. It is recognized that the biological medium in which radiation is

Fig. 3.

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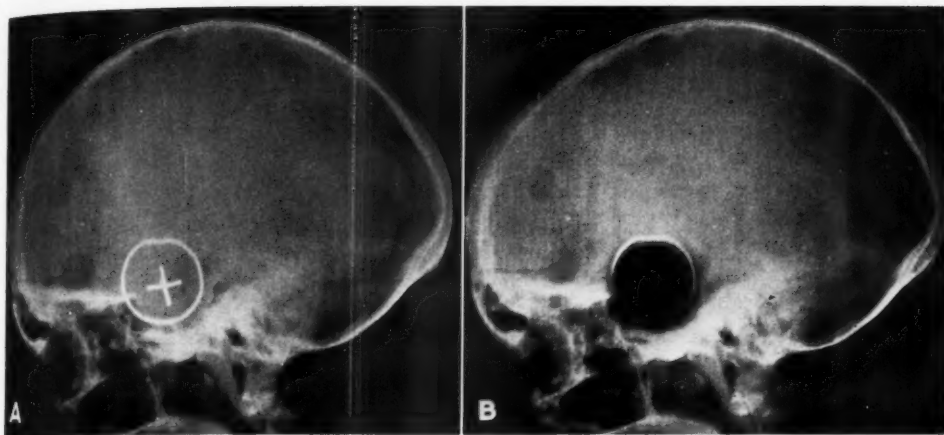


Fig. 3. Alignment for treatment of pituitary. A. Roentgenogram taken with auxiliary x-ray tube. The circle and cross are right and left lead markers. B. Accelerator beam added.

absorbed in the course of treatment may not be uniform in density or chemical composition. Nevertheless, the basic data, to which corrections may be applied to take these factors into account, must come from phantom measurements, and it is to these that we limit our discussion here. Parenthetically we note that for high-energy photons (say, energy >1 MEV) the energy absorbed per unit mass of material (dose) is essentially constant for various biological constituents. The data from phantoms may be used with confidence, provided the region irradiated does not contain large voids.

The techniques for the measurement of absorbed dose in a simple medium like water have not so far become a matter of routine instrumentation where high-energy photons are employed. The impossibility of establishing electronic equilibrium for photon energies above 3 MEV prevents the use of the roentgen unit as an intermediate step in the absorbed dose computation. Developmental effort has largely centered about methods employing calorimeters, ionization chambers, and chemical dosimeters. The calorimeters are primary standards; it is to be expected that when techniques are sufficiently improved and enlarged in scope, other radiation detectors will be calibrated on the basis of a calorimetric reference. At the present state of

development, calibrations of this type have been achieved only to a limited extent. Ionization chambers, when employed as primary references, require recourse to Bragg-Gray theory in order that the response may be interpretable as absorbed dose. The theoretical developments themselves, the physical constants involved, and the manner in which the theory is to be applied to a specific instrument, are receiving careful attention from numerous workers in the field. For the work described here, a chemical dosimeter (6) has been chosen as a reference with the realization that a calibration of the system against a primary standard, preferably a calorimeter, is required for our particular beam. Specifically, the ferrous sulfate (Fricke) system has been chosen.

B. The Chemical Dosimeter: The system chosen for dosimetric reference consists of 10^{-3} M $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ in 0.8 N H_2SO_4 with 10^{-3} M NaCl (7). Under the influence of radiation, some of the ferrous ions are oxidized to ferric ions. This system with various modifications has been extensively studied over a wide range of x-ray energies. The techniques for preparation and analysis are straightforward, and standard chemical procedures are adequate to insure stability and reproducibility.

We summarize here some of the pertinent characteristics and technics for use of the

ferrous sulfate dosimeter. It is customary to characterize a chemical dosimeter by the quantity, G , defined for the ferrous-ferric system as the number of ferrous ions oxidized to ferric ions per 100 ev of absorbed energy. A summary of G values as found by various investigators is given in Table I of an earlier paper (8). We note the following characteristics:

(1) Since the nonaqueous constituents of the chemical dosimeter are in low concentrations, the approximate tissue equivalence of water is not significantly disturbed.

(2) The system has been shown to be independent of dose rate up to levels of 2×10^6 rad/sec (9).

(3) The system has no significant energy dependence for energies higher than 100 kev. It is seen (Table I, *loc. cit.*) that a G value of 15.6 fits the known data, within

ated samples of the solution. A Beckman DU spectrophotometer with absorption cells having a path length of 10 cm. was employed. The absorbed dose in terms of measured quantities is

$$D = K \frac{\Delta A}{\sigma l \rho G}$$

where

D = absorbed dose (rads)

K = constant = 3.69×10^{-12}

ΔA = change in optical density

$$= \Delta \log_{10} \frac{I_0}{I}$$

σ = cross section for absorption at 3,050 Å by Fe^{+++}

$$= 8.35 \times 10^{-18} \text{ sq. cm.}$$

l = path length in absorption cell (cm.)

ρ = density of solution = 1.025 gm./c.c.

G = number of ferrous ions converted to ferric ions per 100 ev of absorbed energy

$$= 15.7^3$$

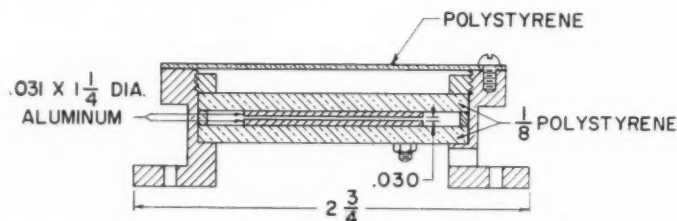


Fig. 4. Parallel plate ionization chamber (monitor).

their experimental accuracies, from 30-MEVp x-rays to 175-kevp x-rays. On this basis it is felt that the use of the Co^{60} calorimetric calibration (10, 11) of the standard ferrous ion system gives an accurate basis for dosimetry of a 4-MEVp x-ray beam. Below 175 kevp, the G value does not drop off rapidly. The error for 8-kevp x-rays is only about 15 per cent. It is felt that in any region of the scattering medium that is of clinical interest, the beam will have a quality of 175 kevp-x-rays or higher. There is some support for this opinion in the work of Goldstein and Wilkins (12).

The response of the chemical dosimeter is obtained by a measurement of the difference in optical density at a wave length 3,050 Å between irradiated and unirradi-

A few comments at this point regarding details of procedure may be helpful to anyone contemplating the use of this technic.

(1) The ferrous sulfate solution is irradiated in polyethylene bottles. These are nominally 1-oz. bottles (38.3 c.c.) with a wall thickness of about 1 mm. The cleansing operation consists of washing in laboratory detergent, rinsing, boiling in distilled water, soaking in 1 N sulphuric acid, rinsing in distilled water, and drying in warm air. Reagent grade chemicals and commercial distilled water are of sufficient purity. Because of the boiling operation, it is necessary to use bottles made of high-melting-point polyethylene.

³ A G value of 15.7 is the mean of the Co^{60} calorimetric calibrations.

(2) Irradiation is performed by immersing the polyethylene bottles (with tight-fitting caps) in a water phantom exposed to the beam. In order to obtain significant changes in optical density, even with the 10-cm. absorption cell, several hundred rads are required. Correspondingly larger doses would be required if absorption cells of shorter path length were employed. The physical size of the dosimeter presents minor complications, as discussed below.

C. Monitors: The chemical dosimeter satisfies the requirements of a calibration standard. Additional instrumentation is therefore required to provide the therapist with information both as to dose rate and total dose at certain relevant locations while the treatment is in progress. This is the function of the monitor system.

The basic component of the system is a

physical significance until a calibration is performed. On the basis of the chemical dosimeter, a factor is obtained which converts the chamber response to rads/min. or total number of rads at the peak of the dose distribution in a water phantom when irradiated under a certain set of conditions of field size, TSD, etc. Most of the calibration factors refer to variations in field size, which for large fields approach a constant. It is possible to preset for a desired integrated dose and have the instrument interlocked with the accelerator to turn the beam off when that has been achieved. This is the normal mode of operation, and it has been found to be reliable and convenient.

The parallel-plate chamber and its associated circuitry are in constant use whenever the accelerator is in operation.

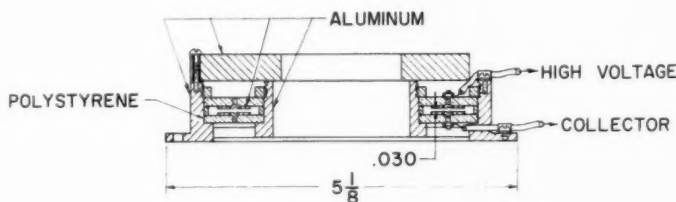


Fig. 5. Annular ionization chamber (monitor).

parallel-plate ionization chamber shown as item C in Figure 1. The details of the chamber are shown in Figure 4 with a variation on this design shown in Figure 5. The latter is an annular, parallel-plate chamber which permits access to the target assembly without removal of the defining unit. Thus, for electron therapy, the x-ray target may be conveniently removed without causing any disturbance to the chamber. (The aluminum plate above the chamber is for protective purposes.) The output of the chamber is connected through a preamplifier to a combined rate-meter and integrator.⁴ The preamplifier is physically located close to the ionization chamber and a long cable connects to the rest of the circuitry.

The response of the chamber has no

A conservative attitude prompted the installation of an independent monitor which consists of a cylindrical ionization chamber together with appropriate circuitry to serve as a check. The latter functions as a ratemeter only. Departure from certain established correlations between the two monitors is an indication of malfunction in one or both systems. In addition, a timer interlocked with the accelerator beam provides a further check on the behavior of the monitor systems.

D. Secondary Standard: To perform periodic checks and calibrations of the monitor system, it is convenient to employ a secondary standard. Victoreen thimble chambers were chosen for this purpose on the basis of their availability and generally reliable operation. It is a relatively simple matter to perform an intercomparison between the thimble chambers and the

⁴Radson, Victoreen Instrument Company, Cleveland, Ohio.

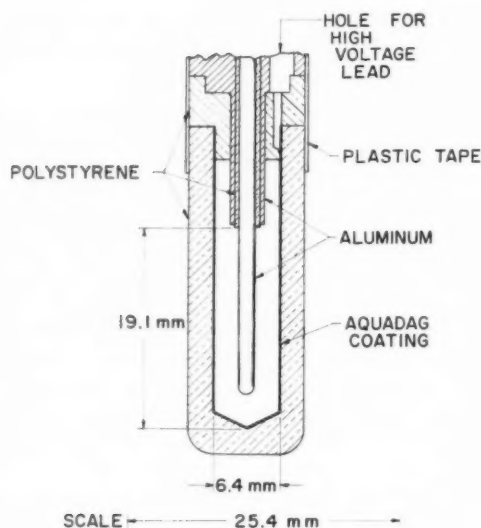


Fig. 6. "Large" cylindrical ionization chamber for measurement of relative dose distributions in a water phantom.

ferrous sulfate system. Thus, a sample of chemical dosimeter, in a polyethylene bottle, is immersed in the water phantom and exposed to the radiation beam for a convenient number of monitor units, corresponding to an absorbed dose of a few hundred rads. Subsequently, the thimble chamber, with a thin rubber protector, is immersed in the phantom at the average position of the chemical dosimeter, and exposed to the beam. The monitor correlates the responses of the chemical dosimeter and the thimble chamber. The readings of the chamber are corrected for ambient temperature and pressure, and are simply called Victoreen units (not roentgens). Four chambers have been calibrated in this manner, and the results are as follows:

Chamber	Rads/Victoreen unit
100 r-high energy	0.90
250 r-high energy	0.99
100 r-medium energy (I)	0.97
100-r medium energy (II)	0.99

It should be noted that these chambers are used elsewhere in the Radiation Therapy Department. They were, therefore, calibrated at the National Bureau of Standards at appropriate x-ray half-value

layers. In the present application, such calibrations have no relevance.

E. Relative Dose Distributions: Relative dosimetric data are commonly presented in the form of isodose curves which are dose distributions normalized to 100 per cent at a suitable reference point, usually taken at the peak of the distribution. Since for this purpose we are concerned not with absolute but with relative dose measurements, it is advantageous to employ detectors whose response is proportional to absorbed dose over a wide range of spectral composition. The spatial resolution of the detector is also important, especially in studying the dose gradients at the geometrical edge of the beam. A compromise between sensitivity and resolution must be made, regardless of the details of the detecting system. Needless to say, it is desirable to obtain the necessary measurements rapidly since a busy therapy installation requires a large number of fields for the cases under treatment.

Two popular schemes for producing isodose distributions are in existence. One is a photographic method and the other depends on ionization chambers (or scintillators). The photographic technic, with film in a Masonite phantom, conserves the operating time of the accelerator since exposures are short and the scanning is performed at a later time. Useful information may be obtained by this means, but in our hands the method had a number of shortcomings⁵ which prompted us to adopt ionization chambers as the basic instruments for relative depth-dose measurements.

The requirements of such a chamber are (1) that it be small enough so that good spatial resolution be obtained, (2) that it be watertight so that it may be used in a water phantom, (3) that its response be proportional to absorbed dose rate in all

⁵ The difficulties arose chiefly from a failure of the film method to correlate properly with the ionization-chamber measurements. Other troublesome features were associated with anomalous blackening and lack of adequate reproducibility. Nevertheless, the film method is currently being pursued under more carefully controlled conditions in an attempt to remove the previously encountered difficulties.

relevant regions of the phantom, which will include, of course, an ion collection efficiency close to unity.

A chamber that satisfies these requirements quite well is shown in Figure 6 (known as the "large" chamber). The active region is 6.4 mm. in diameter and 19.1 mm. long. By making the center electrode of aluminum and the outer cup of polystyrene (with a coating of Aquadag on the inner surface), a close equivalence to water (or tissue) is achieved in regard to atomic number. The guard ring is designed to eliminate regions of low electric field and thus permit good ion collection efficiency. According to criteria established by Boag (13) for pulsed beam operation, a collecting voltage of 15 volts gives an ion collection efficiency of 99.5 per cent for the cylindrical portion of the chamber. Inasmuch as the collection efficiency of the end region is more difficult to predict, the chamber was operated at 250 volts.

To achieve better spatial resolution than is possible with the "large" chamber, a second chamber ("small") was constructed (Fig. 7). Its active region is 3.2 mm. in diameter and 4.7 mm. long. It is made of polystyrene coated with Aquadag on the inside and placed over the end of an RG-58 U cable. The copper center wire of the cable serves as the center conductor of the "small" chamber, and the copper-braid shield of the cable serves as a leakage guard ring. A potential difference of 60 volts is adequate for high collection efficiency since Boag's criteria require only 3.0 volts for 99.5 per cent efficiency in the cylindrical region of the chamber.

The current from the "small" ionization chamber, when it is located at the maximum or 100 per cent point of the dose distribution, is approximately 10^{-11} amperes when the absorbed dose rate at the same point is 60 rads/min. At the 10 per cent point the current is 10^{-12} amperes. Currents of this magnitude are frequently measured by generating a voltage across a high resistance and measuring this voltage with a circuit of high input impedance.

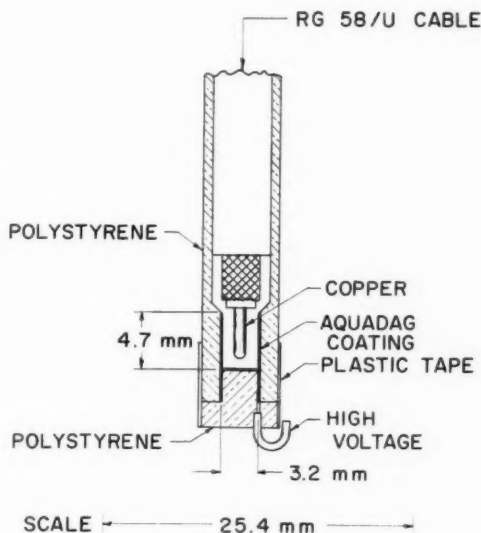


Fig. 7. "Small" cylindrical ionization chamber for measurement of relative dose distributions in a water phantom.

Generally, a feed-back circuit is preferable to avoid excessive time constants. The circuit, shown in Figure 8, is believed to be an improved version of a circuit originally described by Moody (14).

Under conditions where the grid current of the input stage is much smaller than the current from the ionization chamber (i), the voltage (e_0), as measured at the output of the cathode follower, is given by $e_0 = AiR_f/(1 - A)$. R_f is the input resistance (about 10^{12} ohms) and A is the gain of the amplifier (about 300). Thus, when $A \gg 1$, the output voltage becomes independent of the gain of the amplifier and is not disturbed by small changes in circuit parameters. The time constant, τ , is given by $\tau = R_f C_s/(1 - A)$ where C_s is the effective capacity of the input network, including the ionization chamber, connecting cable, etc. Again, it is seen that a high value of A is desirable, if excessive time constants are to be avoided.

The input stage of the amplifier employs a 5886-electrometer tube which is characterized by low grid current and high amplification factor. By returning the plate supply of this tube to the cathode of the cathode follower stage, the effective plate

load resistance of the electrometer tube is increased by positive feedback and, as a result, the gain is increased. With $R_F = 10^{12}$ ohms, it is possible to achieve a time constant of about 0.3 second, which is sufficiently short for this application. A complete analysis of this amplifier has been given by Steele (6).

To eliminate errors associated with fluctuations in accelerator output, it is

time constants of the two detectors are approximately equal). If one now moves the switch on the resistance across the output from the monitor amplifier, R_D , to a point equal to 90 per cent of the total resistance, and then moves the probe chamber until the null-indicating VTVM reads zero, one will find that the probe chamber is located at a 90-per cent point in the phantom. Under these conditions

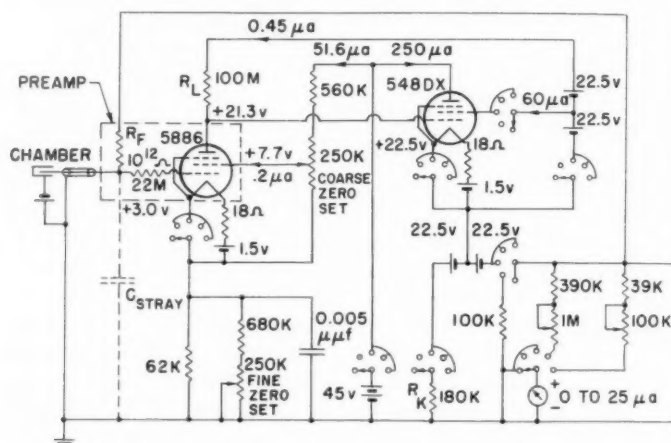


Fig. 8. D.C. amplifier for measuring ionization chamber currents.

necessary to use a monitor chamber and to measure the ratio of the response of the probe chamber in the phantom to that of the monitor chamber. The monitor chamber remains in a fixed location relative to the x-ray beam. Its output is measured by means of an amplifier similar to the one employed with the probe chamber. The ratio circuit is shown in Figure 9. A vacuum-tube voltmeter (VTVM) is connected so as to act as a null-sensing device between some fraction of the signal from the monitor and the signal from the probe. In practice the potentiometer, R_p , connected across the output of the probe chamber amplifier, is adjusted so as to balance the full monitor voltage when the probe chamber is located at the 100-per cent point of the dose distribution. Thus, the difference between these two voltages will remain zero regardless of fluctuation in output of the accelerator (provided the

various points along the 90-per cent contour may be located. In similar fashion points along the 80-, 70- and so on down to the 10-per cent contour may be found. The circuit for the null-indicating VTVM is very similar to the cathode follower portion of the basic electrometer amplifier shown in Figure 8.

The probe chamber in the water phantom must be driven from a location outside of the beam area, and its precise position within the phantom must be known. For this purpose, positioning systems with various degrees of automation are in vogue. A relatively simple system, used here, consists of two identical rectangular co-ordinate units whose motions are synchronized by means of two pairs of selsyn motors driving two pairs of lead screws. One unit carries the ionization chamber probe through the water phantom; the other unit, located outside the radiation vault,

carries a marking device over a sheet of paper. Here the operator can manually move the marker and chamber simultaneously by rotating the lead screws. The marker responds to a push button to make a point on the paper. A set of 10 isodose curves may be plotted in thirty to fifty minutes.

So far, the mechanics of relative depth-dose measurement have been described.

mined from the isodose curves made with the "large" ionization chamber *versus* the response of the chemical dosimeter is shown in Figure 10. Arrows indicate the region over which the numerical averaging was performed for each of the four sample depths. Figure 11 is a corresponding plot showing the comparison of a Victoreen thimble chamber with the "large" water-phantom probe. Thus it may be said that

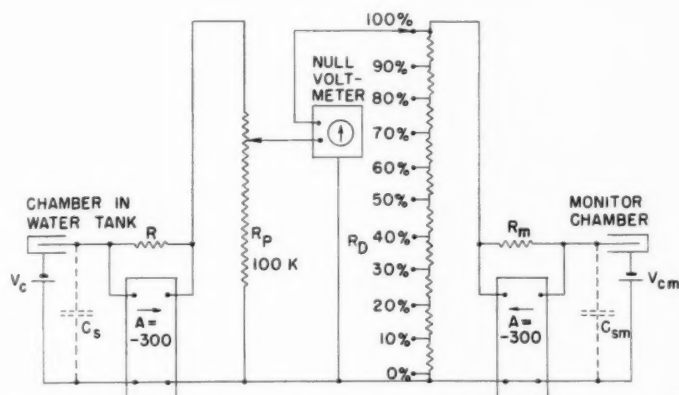


Fig. 9. Ratio circuit for comparing the response of the phantom probe ionization chamber with a monitor ionization chamber.

It is necessary to establish that the measurements have physical significance, that is, that the relative depth-dose determinations are directly proportional to the corresponding values of absorbed dose. Alternatively, should this proportionality not exist, it is necessary to know the nature of the correction.

As has been discussed above, the basic dosimetric reference adopted in this work is the ferrous-to-ferric ion conversion, and the proof of the validity of the depth-dose measurements rests on a comparison with this system. The method of comparison was as follows: The cylindrical polyethylene bottles containing the chemical dosimeter were placed at various depths along the central axis of the accelerator beam. The average depth-dose for each sample was determined by numerically averaging the per cent depth-dose, as given by the isodose curves, over the volume of the bottle. The average depth-dose as deter-

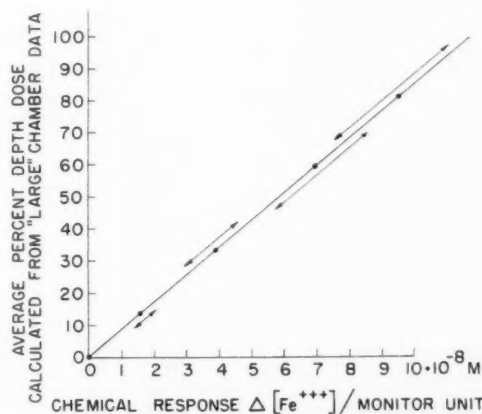


Fig. 10. Comparison of "large" ionization chamber response with the ferrous sulfate dosimeter.

both the probe chamber and the Victoreen thimble chamber exhibit a response which is proportional to absorbed dose over the range of the present investigation. The "small" ionization chamber showed departures from linearity to the extent of about

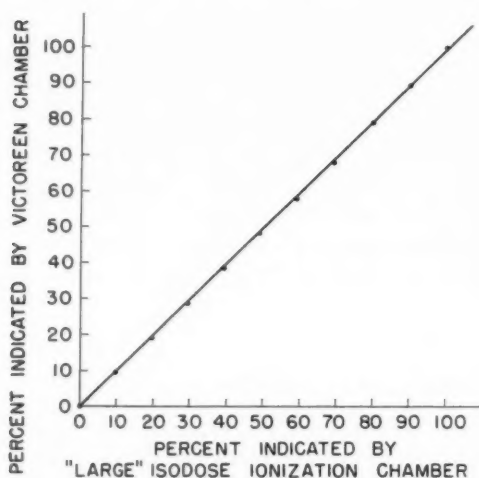


Fig. 11. Comparison of Victoreen chamber with "large" ionization chamber.

2 per cent; hence no serious compromise has been made to obtain the improved spatial resolution.

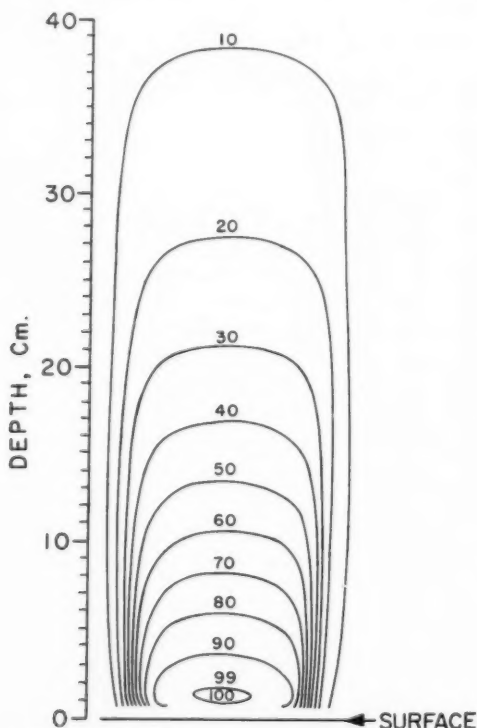


Fig. 12. Relative dose distribution obtained with the 4-MEVp x-ray beam for a 10×10 -cm. field at 100 cm. TSD.

A number of representative dose distributions, obtained by the methods described above, and their application to specific therapy situations, are discussed by Steed (15) and by Kaplan and Bagshaw (5). One example, for a 10×10 -cm. field at 100 cm. TSD, is shown in Figure 12. Figure 13 shows a comparison of central axis characteristics for several types of radiation employed in therapy.

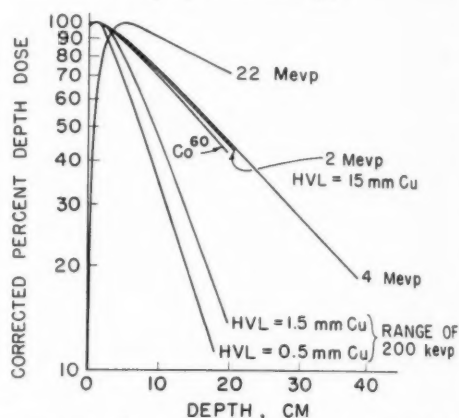


Fig. 13. Comparison of central axis characteristics for a 4-MEVp x-ray beam with beams of other peak energies. The latter are taken from Supplement No. 5 of the *British Journal of Radiology*. Correction for inverse-square-law dependence has been applied to all the data.

SUMMARY

A description is given of the physical and electrical characteristics of a traveling-wave, linear electron accelerator designed to meet the requirements of super-voltage x-ray therapy. Typical operating conditions are at an electron energy of approximately 4 MEV and a forward x-ray intensity at 1 meter from the target of 0.38 milliwatts per square centimeter. The instrumentation and technics associated with various dosimetric measurements are discussed.

ACKNOWLEDGMENT: We acknowledge the contributions of V. A. Prosper, J. Pope, and P. Lee, who together were responsible for the fabrication and processing of the Stanford Medical Accelerator. Mr. Prosper was in charge of the machining operations; Mr. Pope performed the electroforming; and Mr. Lee carried out the final processing operations. Their skill, patience, and imagination are greatly appreciated.

REFERENCES

1. CHODOROW, M., GINZTON, E. L., HANSEN, W. W., KYHL, R. L., NEAL, R. B., PANOFKY, W. K. H., AND STAFF OF HANSEN LABORATORIES OF PHYSICS: Stanford High Energy Linear Electron Accelerator (Mark III). *Rev. Scient. Instruments* **26**: 134-204, February 1955.
2. GINZTON, E. L., MALLORY, K. B., AND KAPLAN, H. S.: The Stanford Medical Linear Accelerator. I. Design and Development. *Stanford M. Bull.* **15**: 123-140, August 1957.
3. GREENE, D., AND TRANTER, F. W.: Dosage Data for 4,000,000 Volt X Rays. *Brit. J. Radiol.* **29**: 193-201, April 1956.
4. MURISON, C. A., AND HUGHES, H. A.: Physical Measurements on a 4-MEV Linear Accelerator. *Radiology* **68**: 367-378, March 1957.
5. KAPLAN, H. S., AND BAGSHAW, M. A.: The Stanford Medical Linear Accelerator. III. Application to Clinical Problems of Radiation Therapy. *Stanford M. Bull.* **15**: 141-151, August 1957.
6. STEELE, R. E.: 4 Mev X-ray Dosimetry. Microwave Laboratory Report No. 475, W. W. Hansen Laboratories of Physics, Stanford University, 1958. Also Ph.D. Dissertation, Stanford University, 1958.
7. WEISS, J., ALLEN, A. O., AND SCHWARZ, H. A.: Use of the Fricke Ferrous Sulfate Dosimeter for Gamma-Ray Doses in the Range 4-40 Kv. *Proceedings of the International Conference on the Peaceful Uses of Atomic Energy*. New York, United Nations, 1956, vol. 14, p. 179.
8. WEISSBLUTH, M., AND STEELE, R. E.: Absorbed Dose; Proposed Experiment for High Energy X-ray Beams. *Stanford M. Bull.* **15**: 210-214, August 1957.
9. SCHULER, R. H., AND ALLEN, A. O.: Yield of the Ferrous Sulfate Radiation Dosimeter: An Improved Cathode-Ray Determination. *J. Chem. Physics* **24**: 56-59, January 1956.
10. LAZO, R. M., DEWHURST, H. A., AND BURTON, M.: The Ferrous Sulfate Radiation Dosimeter: A Calorimetric Calibration with Gamma Rays. *J. Chem. Physics* **22**: 1370-1375, July 1954.
11. HOCHNADEL, C. J., AND GHORMLEY, J. A.: A Calorimetric Calibration of Gamma Ray Actinometers. *J. Chem. Physics* **21**: 880-885, April 1953.
12. GOLDSTEIN, H., AND WILKINS, J. E.: Calculation of the Penetration of Gamma Rays. AEC Report NYO-3075.
13. BOAG, J. W.: Ionization Chambers. [In] *Radiation Dosimetry*, ed. by G. J. Hine and G. L. Brownell. New York, Academic, Press, 1956, p. 174.
14. MOODY, N. F.: An Improved DC Amplifier for Portable Ionization Chamber Instruments. *Rev. Scient. Instruments* **22**: 236-239, April 1951.
15. STEED, P. R.: The Stanford Medical Linear Accelerator. IV. Patient Dosimetry. *Stanford M. Bull.* **15**: 152-158, August 1957.

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SUMMARIO IN INTERLINGUA

Le Accelerator Linear Medical A Stanford II. Installation E Mesuramentos Physic

Es presentate un description del characteristics physic e electric de un accelerator electronic linear a undas viagiante, planate a satisfacer le requirimentos de roentgeno-therapia a supervoltage. Typic conditiones de functionamento es un ener-

gia de electron de circa 4 MEV e un intensitate de radios X, a un distantia de 1 metro ab le pecia de concentration, de 0,38 milliwatt per centimetro cubic. Le instrumentation e le technicas associate con varie mesurationes dosimetric es discutite.



A Body-Cavity Dosimeter¹

FRANK E. HOECKER, Ph.D.,² and HOMER L. HIEBERT, M.D.³

THROUGHOUT THE history of radiological physics, the search for an ideal body-cavity radiation dosimeter has been continuous. Many forms have been tried, but each has failed to fulfill one or more of the necessary or desirable characteristics. Even the gas-filled thimble-type ionization chamber in its standard form suffers from its large size, susceptibility to moisture, and the shadow-effect of the stem. These objections can be overcome by special design and construction, but such chambers are not available for routine use by the practicing radiotherapist. Even so, no other form of dosimeter has approached the general acceptance which has been accorded the thimble chamber.

In extension of this search for the ideal dosimeter we have explored the quantitative response of certain substances which may be polymerized by high-energy radiation, with a view to their possible use for measuring dosage. It is of interest to note here that in certain respects the action of radiation on these substances is similar to its effects on the molecular components of the tissues of biological organisms. These effects may be generalized into two processes—degradation and complexing, the latter term referring to the process of chain-building and cross-linking. The ultimate behavior of the irradiated monomer-polymer system will depend upon which process predominates.

In some substances, such as albumin, the process of degradation appears to predominate; fresh egg white is reduced to a thin, watery consistency. In other substances, the polymerization process appears to predominate. Certain of these which are normally liquid are converted to a gel or a solid as the consequence of exposure to sufficiently large doses of high-energy

radiation. Some of these substances are very similar in their atomic composition to tissue; in others the composition may be varied to simulate that of tissue without impairing their radiation response.

The quantitative study of the radiation response of such a substance depends upon the existence of a sharp change in some property which is easily and conveniently observable. Our observations have made use of gel phase polymerization, a process well known in high polymer chemistry, in which the rate of polymerization and the molecular weight of a substance increase suddenly. Charlesby in 1954 (1) called attention to the change in the properties of polymers brought about by exposure to radiation and showed, for example, that the melting point of certain paraffins undergoes a very sharp, almost discontinuous, increase upon exposure to large radiation doses. Changes in density, index of refraction, and viscosity may be detected but are difficult to observe quantitatively without appropriate instruments.

Although many substances have exhibited alterations in their properties in response to radiation, most of these require mega-roentgen doses and offer little hope of usefulness in lower dose ranges. Several substances have been examined by us, but intensive studies have been confined to one, a styrene-polyester which is converted from a liquid to a gel upon exposure to approximately 50,000 r of x-radiation.

A radiation-sensitive polymer, to be suitable as a dosimetric substance, must fulfill all the requirements usually sought in a dosimeter, *i.e.*, tissue equivalence and radiation response independent of radiation energy, dose rate, and temperature. It must also possess properties which are

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Fig. 1. Dosimeter cell holder for use in measuring vaginal or colon tissue dose.

peculiar to the manner in which it is to be used; namely, a sharp end-point index which will permit detection of small differences in dose, stability at room and body temperatures, and the radiation-induced polymerization must be a linear function of the radiation dose and self-terminating with termination of irradiation or within a few minutes thereafter.

The polymer mentioned above has been investigated with respect to some of these desirable properties. The cells described below, which were used to obtain numerical data, are suggested as one possible form suitable for body-cavity dosimeters to measure the actual tissue dose delivered. When used in this manner the dosimeter may be introduced directly into a body cavity, its small size making it suitable for positioning under the tongue or in the descending colon. It could be introduced in the cervical canal or held in position against the cervix by means of the applicator shown in Figure 1. With this device,

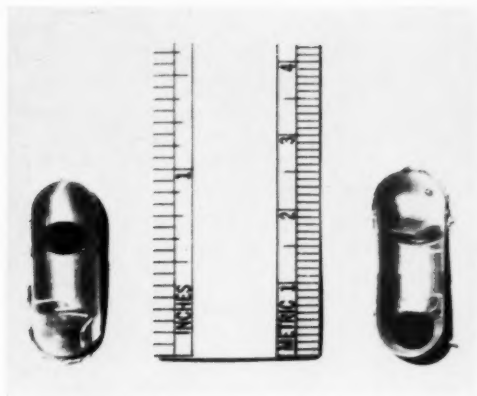


Fig. 2. Dosimeter cells. The cell on the left has been exposed to gelation dose and inverted.

either one cell or three cells may be used at one time. The latter arrangement permits the use of one cell to indicate when half the desired tissue dose has been delivered, one to indicate when the total intended dose has been delivered, and one to check the dose by the procedure described below. The cells held in a cavity in the end of the applicator are covered with a finger cot to exclude moisture.

The dosimetric liquid is contained in an ordinary gelatin capsule (size 000 or smaller) in which is also included a small lead shot and/or a gas bubble (Fig. 2). The small size of the dosimeter, the similarity of radiation effect to that in tissue, and the ease with which the cell may be made tissue-equivalent are notable features which indicate the desirability of investigation of other properties. Polyethylene capsules have been used in place of gelatin to overcome the moisture susceptibility.

For purposes of quantitative study of the dosimetric material, the cells are supported with their long axes parallel to the direction of the radiation and in a ring concentric with the axis of the beam, in a block of plastic foam. Back-scatter is minimized and the ring of cells is rotated about the center in order to insure uniformity of irradiation. The cells may be placed (Fig. 3) within 10 cm. of the target of a beryllium-window, 250-kv, 30-ma General Electric Maxitron x-ray unit, where the

radiation intensity at maximum tube voltage and current is approximately 5,000 r/min. when filtered with 0.55 mm. Cu. The x-ray beam is continuously monitored by a Victoreen dose-rate meter. When cells are calibrated for dosimetric use inside the body, they are embedded in a ring turned in a solid block of Lucite, as shown in Figure 4. Under these conditions approximately 10 per cent of the total dose is due to scattered radiation.

Gelation is indicated by failure of the lead sphere or bubble to move to the end of the cell when it is inverted after irradiation. When the cell is used as described above to obtain quantitative data, the extent of gelation from top to bottom, as indicated by the final position of the lead sphere in the inverted cell, may be expressed in millimeters of gelation, and this in turn calibrated in terms of dose per millimeter. When calibrated for use in a

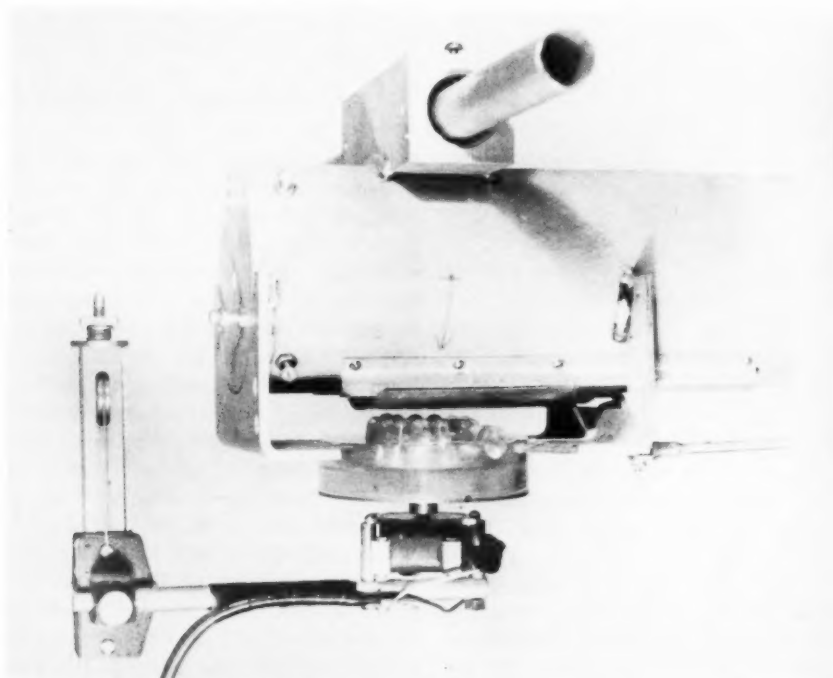


Fig. 3. Experimental arrangement of dosimeter cell holder in the x-ray beam.

The Lucite block is drilled so that a Victoreen 2,500-r black nylon thimble chamber may be exactly positioned within the cell ring to measure the dose actually received at the desired level in the dosimeter cells. Under the conditions described, the primary beam intensity varies rapidly with distance along the axis of the cell, although not in conformity with the inverse-square-of-the-distance law because the focal spot on the target is large in comparison with the distance of the cell from this spot.

body cavity, the cell must be uniformly irradiated. Under these conditions, the dosimeters are go, no-go; that is, gelation will be either uniform and complete or not at all, and the dosimeter will indicate whether the dose for which it was calibrated was received.

It has been shown (2) that the styrene polyester used has a radiation dose response independent of the energy of the radiation when the low-energy components responsible for photoelectric absorption are removed by filtration. The gelation dose

increases markedly at low energies, but lack of monochromatic radiation has prevented investigation of the quantitative relationship between dose and energy. At 100 kv, with only the inherent filtration of the 1.5-mm. beryllium window, the gelation dose is approximately 30 per cent greater than with 250-kv radiation filtered by 0.55 mm. Cu. From this it is clear that a dosimeter cell to be used in a body cavity must be calibrated with radiation having the same energy composition as that to which it is to be exposed. It is necessary, therefore, to calibrate the dosimeter cell in a phantom with the factors to be used in treatment.

TABLE I

Cells No.	Pre-irradiation Dose (r)	Added Gelation Dose (r)	Total Gelation Dose (r)
2 Controls	78,675	None	78,675
1 & 2	10,490	68,185	78,675
3 & 4	20,980	68,185	89,165
5 & 6	31,470	68,185	99,655
7 & 8	41,960	57,695	99,655
9 & 10	52,450	57,695	110,145
11 & 12	57,695	47,205	104,900
2 Controls	None	78,675	78,675

While it is possible to prepare dosimetric substances which are more sensitive, the most easily prepared and most conveniently handled has a threshold dose of approximately 50,000 r. This is considerably above the therapy dose range and, when this material is used, one of two procedures must be followed: (1) The dosimeter cell may be placed in the body cavity and the desired radiation dose administered. Upon removal, the cell is exposed to additional measured radiation until gelation occurs. The unknown dose is then the difference between the threshold calibrated dose and the subsequently measured dose. (2) The cell may be pre-irradiated with a measured dose less, by any desired amount, than the threshold calibrated dose. The cell will then indicate when this residual dose has been delivered. The accuracy of either method depends upon the radiation response of the dosimetric liquid being strictly independ-



Fig. 4. Dosimeter cell holder showing Lucite plug in position designed for Victoreen dosimeter chamber. Cells are arranged in two concentric rings with a single cell at the center.

ent of dose rate and upon the absence of aftereffect. Radiation doses less than the threshold dose must be strictly additive.

The additivity of doses delivered to the substance has been investigated by exposing different groups of cells to different fractions of the gelation dose and then at some later time exposing each group to a sufficiently large additional dose to cause gelation. Table I shows the results of one such experiment, in which the gelation dose was delivered twenty-four hours after the pre-irradiation dose.

The tabulated data indicate that the total dose required for gelation increases as the pre-irradiation dose is increased. We interpret this effect as dose rate dependence when the dose rate is very low. Data obtained earlier (2) indicated the absence of significant dose rate dependence for dose rates between 500 and 5,000 r per minute. The data shown above would correspond to a dose rate of less than 100 r/min. for the largest doses required. The effect is believed to be due to decay of metastable radicals with time. Qualitatively this effect has a striking resemblance to the recovery of biological tissue when the dose is fractionated.

It is noteworthy that gelation did not proceed to completion even in cells exposed

to doses within 25 per cent of the gelation dose. It seems clear that the chains are self-terminating.

Because of the nature of this dosimeter, it is susceptible to a variety of errors not common to other types. One of these is the effect of agitation of the dosimetric liquid during irradiation. It has been found, for example, that 7 cells which are disturbed only enough to test for movement of the lead ball or the bubble polymerize at a dose of $47,200 \pm 6$ per cent, while 7 identical cells exposed with these but inverted after each 5,000 r units, so that the dosimetric liquid is thoroughly mixed by movement of a large bubble from one end of the cell to the other, fail to polymerize after exposure to more than 100,000 r. This effect is due in part to the fact that gelation occurs first near the upper surface of the liquid as a consequence of the greater radiation dose at this point as compared with the dose at points farther from the target. Mixing of the liquid in the cell would tend to average the dose throughout the cell. Calibration measurements of the dose rate at the upper liquid surface and at the levels of the bottom of the cell show that the difference is only about 20 per cent and entirely inadequate to account for the effect. This is not surprising when one considers that gelation depends on the formation of long chain molecules extensively cross-linked. It has been observed in chemical polymerization that gelation is inhibited by agitation, presumably as a result of the breaking of some chains and possibly some cross links. The gelation by radiation appears to be inhibited in the same manner.

This effect is of importance when the cell is to be used to measure tissue dose, because it is difficult to handle the cell, even in the applicator shown, without

considerable change in its position and consequent mixing. This difficulty has been overcome by filling the cell completely and excluding bubbles of gas. To accomplish this, the liquid is introduced into a sealed gelatin capsule through a small hole in the smaller diameter end. This is then covered by a second cap fitting tightly against the hole. Expansion of the liquid is permitted by an overflow through the hole into this cap.

Soft-tissue equivalence of this material in the liquid state has been investigated by comparing absorption data from increasing thicknesses with absorption data for beef muscle for 250-kv radiation filtered through 0.55 mm. Cu. The absorption data for the dosimetric liquid fall on the absorption curve for the beef muscle, although the absorption data for the solidified substance do not, as a result of its increased density. It seems clear, therefore, that the small dosimetric cell containing this liquid, when embedded in soft tissue, will not disturb the quality or distribution of the radiation delivered to the tissue.

It is not our intention to imply here that the proposed dosimeter is a finished, perfected instrument, but rather to point out some of its possibilities and indicate the direction of further needed development. The small size, the tissue equivalence, the cheapness and expendability, and the ease of reading without auxiliary equipment would seem to justify further exploration.

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REFERENCES

1. CHARLESBY, A.: *Proc. Roy. Soc., London, A.* 222: 60-74, 1954.
2. HOECKER, F. E., AND WATKINS, I. W.: *Internat. J. Appl. Radiation and Isotopes* 3: 31-35, 1958.

SUMMARIO IN INTERLINGUA

Un Dosimetro Al Uso In Cavitates Del Corpore

Es describe un nove typo de dosimetro de radiation, consistente de un polyester styroenic que es convertite ab fluido in gel post exposition a circa 50.000 r. Le micre dimensiones del dosimetro rende possibile placiare lo sub le lingua, in le colon descendente, o in le cervice.

Le fluido dosimetric es continite in un ordinari capsula de gelatina (calibre 000 o minus), in que es etiam includite un micre perla de plumbo e/o un bulla de gas. Gelation se indica per le refuso del plumbo o del bulla de mover se al altere extremitate del cellula dosimetric quando le cellula es invertite post le irradiation.

In le manipulation de substantias dosimetric con un dose liminal de circa 50.000 r, un de duo methodos debe esser usate.

(1) Le dosimetro es placiare in le cavitate del corpore, e le desirate radiation es administrate. Post retirar le cellula, mesurate quantitates additional de radiation es

applicare usque le gelation occurre. Le incognoscite dose es allora le differentia inter le calibrate dose liminal e le subsequentemente addite dose mesurate. (2) Le cellula es pre-radiare con un dose mesurate que es minus—per non importa qual desirate quantitate—que le calibrate dose liminal. Le cellula es allora preste a indicar quando le dose residue ha essite applicate.

A causa del natura de iste dosimetro, illo es subjecte a causas de error que non es commun in altere typos. Un tal es le effecto de agitation del fluido durante le irradiation. Es describe medios pro resolver iste difficultate.

Le micre dimensiones de iste nove typo de dosimetro, su equivalentia a histo, su incostositate, su re-implaciabilitate, e le facilitate de interpretar su resultatos sin apparatus auxiliari pare justificar un exploration additional de su qualitates.



The Pseudonotch of the Atlas¹

VAHE MEGHROUNI, M.D.,² and GEORGE JACOBSON, M.D.

IN THE ANTEROPOSTERIOR view of the atlanto-axial joint, there is very frequently seen a notch-like radiolucent defect in the medial portion of the articular mass of the atlas. While in some individuals this may be entirely absent, in others it may be so prominent that it can be mistaken for a fracture or even a destructive process (Fig. 1). However,

the frequency with which this shadow is encountered and the fact that it is almost invariably bilateral make it apparent that it is produced by normal anatomic structures.

Since no previous description of this shadow could be found, this study was undertaken to identify the structures by which it is produced (1, 2).

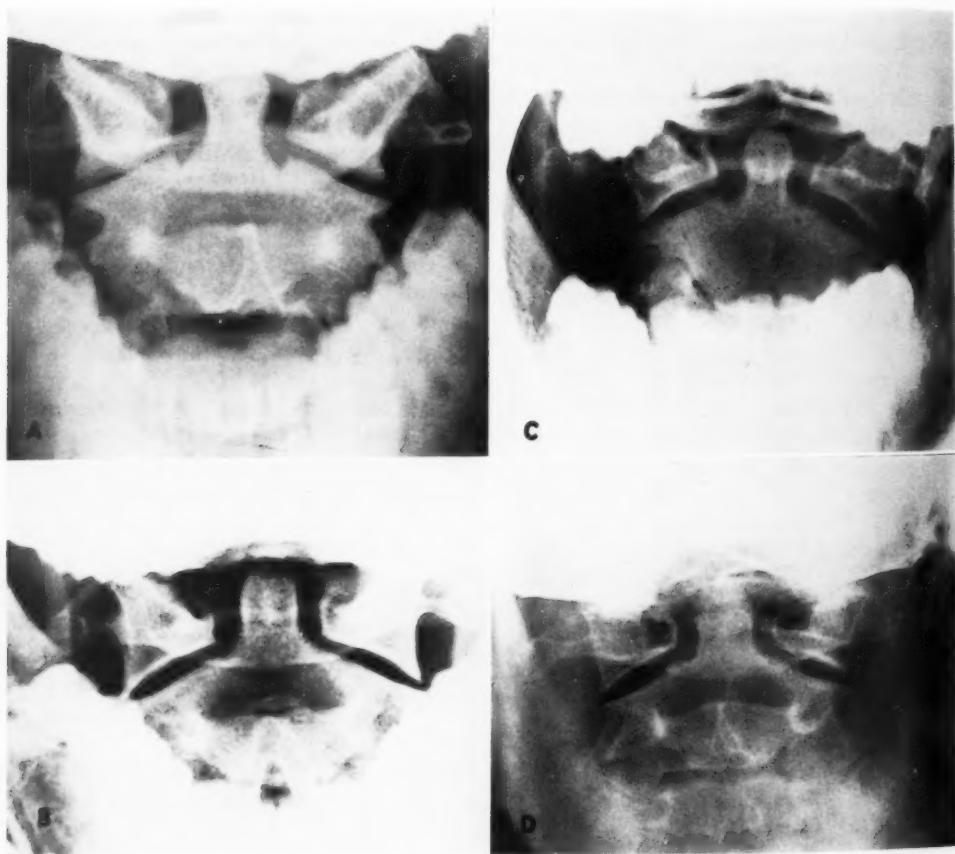


Fig. 1. The appearance of the pseudonotch of the atlas may vary greatly: A. It is entirely absent. B and C. It is moderately prominent. D. It is so conspicuous that, were it not for the fact that the shadow is bilaterally symmetrical, it might be mistaken for a destructive process.

¹ From the Departments of Radiology, School of Medicine, University of Southern California, and Los Angeles County Hospital, Los Angeles, Calif. Accepted for publication in May 1958.

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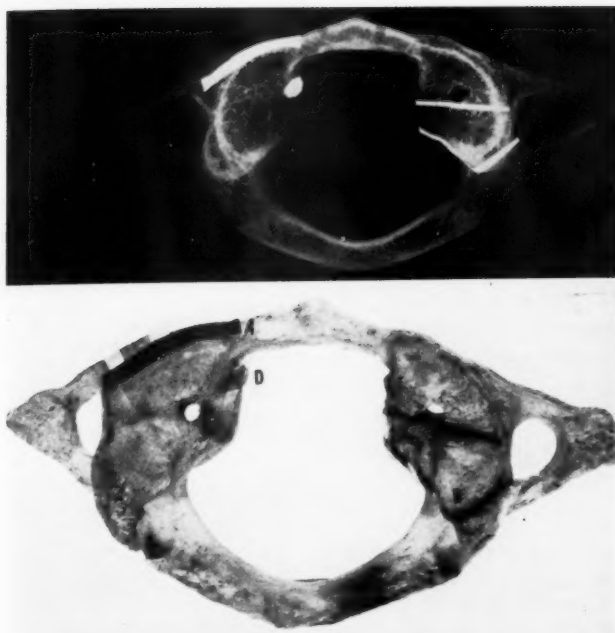
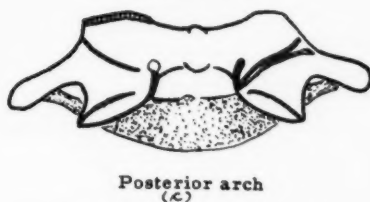


Fig. 2. Lead markers have been placed on (A) anterior edge of superior articular facet, (B) posterior edge of superior articular facet and medial border of lateral mass, (C) concavity of the superior facet and medial aspect of lateral mass, and (D) medial tubercle of the lateral mass. (The defect in the center of the lateral mass is an artefact.)



Anterior arch



Posterior arch
(c)

Fig. 3. Anteroposterior projections: (a) 5 degrees caudal tilt, (b) central ray perpendicular, (c) 5 degrees cephalic tilt. The latter approximates the open-mouth view of the atlanto-axial joint obtained *in vivo* (Fig. 1). The pseudonotch is formed by the medial tubercle of the lateral mass, the articular surface of the inferior facet, and the concavity and posterior edge of the superior facet.

METHOD

Lead strips were placed on various portions of the superior articular facets of the lateral masses of the atlas (Fig. 2): (A) the anterior edge; (B) the posterior edge and posteromedial surface; (C) the nadir of the concavity of the facet and medial aspect of the lateral mass; (D) the medial tubercle of the lateral mass. Radiographs were then made in the antero-posterior projection (Fig. 3): (a) with 5 degrees caudal tilt; (b) central-ray perpendicular; and (c) 5 degrees cephalic tilt.

RESULTS

From a study of these various views, it is apparent that the notch-like defect, which may be called the pseudonotch of the atlas, is formed *medially* by the margin of the medial tubercle of the lateral mass, which is continuous *inferiorly* with the articular surface of the inferior articular facet, and *laterally* by the most concave portion of the superior articular facet. When the roentgen beam is angled cephalad, the posterior edge of the superior articular facet contributes to the lateral limit of the

pseudonotch. This corresponds to the projection of the atlas obtained in making an open-mouth view of the atlanto-axial joint *in vivo*. It is also probable that the radiolucency is caused in part by the nutrient artery, which enters the atlas just posterior to the medial tubercle.

The prominence of the pseudonotch varies somewhat with the angle of projection but depends more on the size and thickness of the medial tubercle.

SUMMARY

The pseudonotch of the atlas, a notch-like radiolucent defect in the medial portion of the lateral mass, is described and its borders are demonstrated. Its conspicuousness depends primarily on the prominence of the medial tubercle of the atlas.

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REFERENCES

1. METTLER, F. A.: Neuroanatomy. St. Louis, C. V. Mosby Co., 2d ed., 1948, p. 25, Figure 4A.
2. GRAY, H.: Anatomy of the Human Body. Edited by C. M. Goss. Philadelphia, Lea & Febiger, 26th ed., 1954, p. 140.

SUMMARIO IN INTERLINGUA

Le Pseudo-Incisura Del Atlante

Le pseudo-incisura del atlante es descripte. Simile a un incisura, illo es un defecto radioluciente in le portion medial del massa lateral del atlante. Illo es formate per le tuberculo medial del massa

lateral, le superficie articular del facetta inferior, e le concavitate e le margine posterior del facetta superior. Su prominentia depende primarimente del dimensiones e del spissitate del tuberculo medial.



An External Lead Shutter System for Supervoltage Roentgenography¹

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BERNARD ROSWIT, M.D., SOL M. UNGER, M.D., and EDMUND KERUT, M.E.

MEDICAL radiography in the supervoltage range has recently become an area of clinical and investigative interest for specialized diagnostic procedures. These include exploration of soft-tissue densities in the head, neck, and thorax, and portal verification in supervoltage therapy (1-5).

Conventional timers on therapy machines are regarded as unsatisfactory because they permit radiation exposure to the patient during the "build-up" time of the generator. Tuddenham, Hale, and Pendergrass (5) have suggested the use of an external lead shutter mechanism activated by a conventional impulse timer

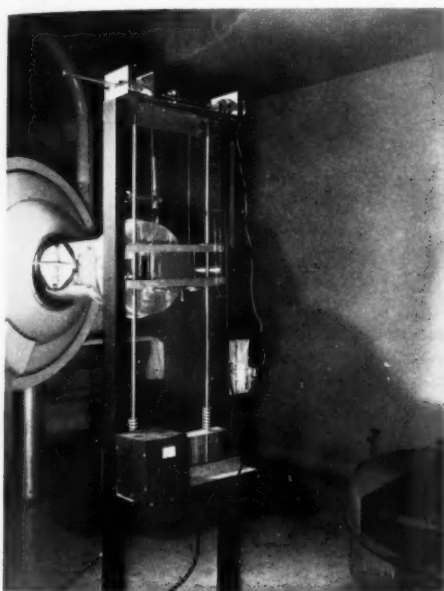


Fig. 1. Photograph illustrating relative positions of external lead shutter device and x-ray machine.

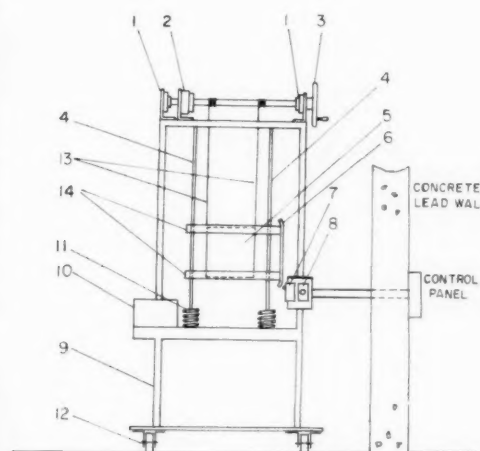


Fig. 2. Schematic drawing illustrating the component parts of lead shutter. 1. Bearings. 2. Brake. 3. Shutter return handle. 4. Guide rails. 5. Lead shutter, 6" X 6" X 2" (high Burnell rating). 6. Microswitch actuator. 7. Microswitch. 8. Brake release switch. 9. Support frame. 10. A.C. to D.C. converter. 11. Springs. 12. Rollers. 13. Shutter wire supports. 14. Shutter frame.

In our Radiation Clinic, we employ a resonance transformer generator operating at 1,000 kv., with 1 mm. lead filter, h.v.l. 3.9 mm. Pb, TSD 70 cm., 3 ma, and an output of 60 r/min. A postero-anterior radiograph of the chest on industrial type C film requires a dose of 1.5 r, measured at the back of the patient, and an exposure time of three seconds.

and out of direct contact with the generator. We have designed and constructed such a lead shutter system for use with our 1,000-kv. therapy machine. The use of this device reduces the dose to the patient from 1.5 r to 1.1 r, or 26.6 per cent. It may be easily constructed and adapted for use with other supervoltage or orthovoltage x-ray therapy equipment.

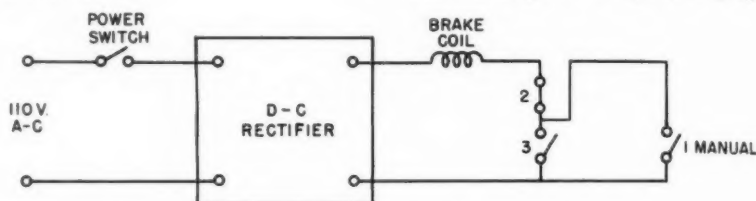
¹From the Physics Research Laboratory, Therapeutic Radiology Service, VA Hospital, Bronx, N. Y. Accepted for publication in May 1958.

In the horizontal position most x-ray heads, like ours, are perfectly counter-balanced. Any attempt to install a shutter system on the face of the port would cause an imbalance requiring considerable engineering for correction. Furthermore, repeated impact from constant use might injure the tube. For these reasons, a separate shutter mechanism had to be constructed out of direct contact with the generator. In Figure 1 are shown the relative positions of the shutter and the x-ray machine. Figure 2 is a schematic drawing of the system.

The cost of the parts is modest, and a skilled technician can readily assemble and wire the unit.

SUMMARY

A simplified external lead shutter system for supervoltage roentgenography is described. Its usefulness lies in the fact that it significantly reduces exposure to the patient during the "build-up" time of the generator. Furthermore, because it is removed from the x-ray machine, it does not impair the balance of the x-ray head through its weight, or jeopardize the



- Switch 1. Operator control (ON-OFF) switch for shutter, outside x-ray room.
- Switch 2. Release switch (normally closed) to return shutter to operating position.
- Switch 3. Brake switch (normally open) activated by descending shutter to brake fall.
- Switch 2 and 3 located inside x-ray room connected on shutter frame.

Fig. 3. Schematic drawing of electrical wiring of lead shutter system and "brake" assembly.

Basically the shutter operates as follows: the lead shutter, weighing 25 lbs. ($6 \times 6 \times 2$ inches), is raised manually by a crank located on the top of the frame and connected to the shutter by wire supports (Fig. 2). An A.C./D.C. converter switch is thrown, activating a brake which holds the entire shutter mechanism at whatever height is selected. When peak x-ray voltage is reached, a push-button switch outside the therapy room releases the brake, allowing the shutter to fall freely by gravity until it makes contact with an actuator located near the bottom of the frame. The actuator makes contact with a microswitch, which again energizes the brake, stopping the fall of the lead shutter. In the event of a power failure, a spring system absorbs the fall of the shutter. Figure 3 illustrates the electrical con-

struction. The cost of the parts is modest, and a skilled technician can readily assemble and wire the unit.

life of the tube through impact. It may be adapted for use with any supervoltage or orthovoltage x-ray therapy machine.

ACKNOWLEDGMENT: We express our appreciation to Mr. Charles Spreckels and Mr. Louis Maddalone for their technical assistance in this project.

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REFERENCES

1. BUECHNER, W. W., VAN DE GRAAFF, R. J., FESHBACH, H., BURRILL, E. A., SPERDUTO, A., AND MCINTOSH, L. R.: An Investigation of Radiography in the Range from 0.5 to 2.5 Million Volts. *A.S.T.M. Bull.*, No. 155, pp. 54-64, December 1948.
2. McDONNELL, G. M., BERMAN, H. L., AND LODMELL, E. A.: Supervoltage Roentgenography. *Am. J. Roentgenol.* **79**: 306-320, February 1958.
3. TUDDENHAM, W. J., GIBBONS, J. F., HALE, J., AND PENDERGRASS, E. P.: Supervoltage and Multiple Simultaneous Roentgenography—New Techniques for Roentgen Examination of the Chest. *Radiology* **63**: 184-190, August 1954.

4. TUDDENHAM, W. J., HALE, J., AND PENDERGRASS, E. P.: Supervoltage Diagnostic Roentgenography. A Preliminary Report. *Am. J. Roentgenol.* **70**: 759-765, November 1953.

5. TUDDENHAM, W. J., TRISTAN, T. A., McDONNEL, G. M., PENDERGRASS, H. P., AND STANTON, L.: Diagnostic Megavoltage Radiography. *M. Radiogr. & Photogr.* **33**: 58-65, 1957.

SUMMARIO IN INTERLINGUA

Un Systema De Obturator Externe De Plumbo Pro Roentgenographia A Supervoltage

Es describe un simplicate systema de obturator externe de plumbo pro roentgenographia a supervoltage. Su utilitate resulta del facto que illo reduce significative-mente le exposition del patiente durante le tempore de "calefaction" del generator. In plus, proque illo es retirate ab le machina

de radios X, illo non disturba le balancia del capite de radiation per su peso e non impericula le vita del tubo per collisiones con illo. Iste obturator es facile a construir e a adaptar al uso con omne machina de roentgeno-therapia a supervoltage o a orthovoltage.



Development of a Room Specifically Designed for Total-Body Irradiation¹

OTTO D. SAHLER, M.D.

THE WORK OF Barnes and his associates suggested a possible new approach to the treatment of leukemia. In order to translate their experimental work on the mouse to man, at least two things are necessary: first, an adequate, readily available source of transplantable human bone marrow of a type which will take in the irradiated recipient; second, a source of radiation which will insure a total-body dose of radiation as nearly uniform as possible.

A perusal of the available sources of radiation in the northeastern section of the country failed to disclose any available sources that would give a fairly uniform dosage distribution throughout the human body. Consultation with Dr. John Trump of the Massachusetts Institute of Technology, Dr. Dale Trout of the General Electric Company, and Mr. Donald Green of Picker X-ray led to the conclusion that optimum distribution could be obtained only by using two sources of radiation at an angle of 180° to each other. The consultants unanimously agreed that cobalt 60 would be the best source of radiation because of its constant output, the freedom from breakdowns, and the possible need of prolonged (24-hour plus) continuous treatments.

In order to include a 72-inch body, from the top of the head to the tips of the toes, either an unusually long room would be necessary or the exit angle of the radiation from the source would have to approach 60° at a distance of 2 meters from each source. Fortunately the thickness of the human body in the lateral projection resembles a double tapered fly line. The decrease in radiation at the foot and head ends, due to the greater distance of these points from the

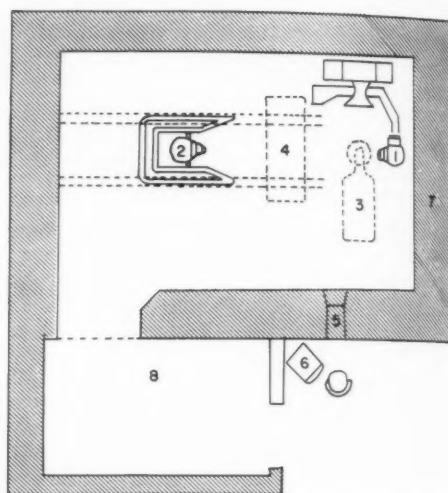


Fig. 1. Plan of room for total-body irradiation. Room measures $23'1'' \times 16'10''$. 1. 1000-rhm rotating cobalt 60 machine. 2. Rail-mounted 750-rhm cobalt 60 unit. 3. Treatment table for rotational therapy. 4. Couch or bed in position for total body irradiation. 5. Viewing window. 6. Closed circuit television and control panels. 7. Concrete barrier wall. 8. Entrance corridor.

source of radiation, will in part be compensated for by the decreased thickness of the body in these areas. A rotating source of radiation seemed advisable, so that the room could be used for more conventional forms of therapy when not in use for total-body irradiation or in the event of failure of treatment by total-body irradiation plus bone marrow transplantation in man.

It was felt that the two sources should be fairly close in the rhm output and that this output should be sufficiently high that a dose of 1,200 r to each side of the body could be delivered in twenty-four hours if such a dose were found to be necessary. For this reason we selected a 1,000-rhm source as the main or rotational source and a 750-rhm industrial type of cobalt unit as the second

¹ From the Mary Imogene Bassett Hospital, Cooperstown, N. Y. Accepted for publication in May 1958.

source. The 1,000-rhm source can be rotated so that the head is close to the wall and the head turned so that the back stop, if used, will not be in the direct beam. The collimating device will have to be removed during treatment in order to obtain a sufficiently wide exit beam. The 750-rhm unit is designed to have a wide exit beam and, since it will not be utilized for more conventional therapy, it will not be equipped with the usual collimating device. The 750-rhm unit will be mounted on rails so that it can be brought

closer to or removed farther from the 1,000-rhm source. The room is designed so that a distance of 3 meters to the patient from each of the sources can be obtained, but most of the total-body treatments will probably be carried out at a distance of 2 meters.

Mary Imogene Bassett Hospital
Cooperstown, N. Y.

REFERENCE

BARNES, D. W., AND LOUITT, J. F.: Treatment of Murine Leukaemia with X-rays and Homologous Bone Marrow. *Brit. J. Haemat.* **3**: 241-252, July 1957.

SUMMARIO IN INTERLINGUA

Elaboration De Un Camera, Specificamente Planate Pro Le Irradiation Del Corpore Total

Esseva construite un camera pro render possibile le irradiation del corpore total, in le spero de tractar leucemia in humanos per un combination de irradiation del corpore total e de transplantation de medulla ossee. Le dimensiones del camera es 23 pedes e 1 pollice per 16 pedes e 10 pollices. Le camera alberga duo apparatusos a cobalt:

un emanator rotante e un plus micre apparato de typo industrial que es montate super rotas. Le dimensiones del camera permette le irradiation del patiente per le un e le altere apparato ab un distantia de 3 metros, sed il es probabile que in le majoritate del casos le irradiation del corpore total va esser effectuate ab 2 metros.



Retrograde Left Cardioangiography as a Test of Valvular Competence¹

KURT AMPLATZ, M.D., RICHARD ERNST, M.D.,
RICHARD G. LESTER, M.D., C. WALTON LILLEHEI,
M.D., and ANDREW LILLIE, M.D.

To the present time there has been no simple or reliable method for differentiating mitral stenosis from mitral insufficiency. The correct diagnosis has great practical importance to the surgeon, who must decide whether open or closed heart surgery should be employed to correct the defect.

soft wire spring is gently brought in contact with the aortic leaflets. At the end of systole the spring spontaneously slips between the valvular leaflets into the left ventricle. The double curvature at the tip of the catheter usually makes it possible to introduce the wire stylet even into tightly stenotic valves without injury. After the spring stylet has passed into the left ventricle, the catheter is advanced and placed in the apex of the left ventricle to minimize the occurrence of extrasystoles.

The injection of 35-50 c.c. of opaque medium is made slowly during a period of at least four consecutive ventricular systoles. This slow injection

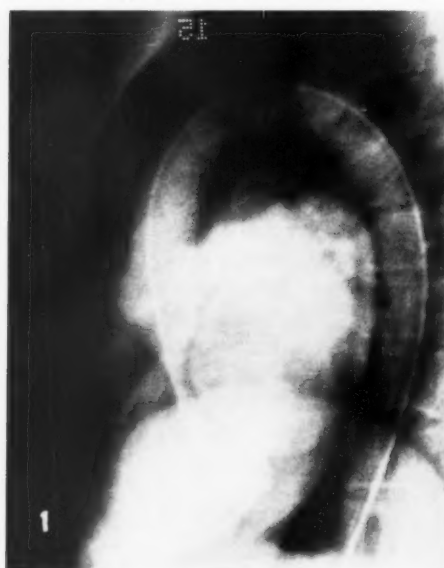


Fig. 1. Marked mitral insufficiency. Note: Left ventricle in systole. Dense filling of left atrium.



Fig. 2. No evidence of mitral regurgitation.

Left heart catheterization with pressure and flow measurements has proved valuable in purely stenotic mitral lesions. In the presence of insufficiency, atrial fibrillation, or failure, however, the interpretation of these curves has been complicated and often disappointing. A practical technic of left cardioangiography has been developed to evaluate the degree of mitral and aortic insufficiency.

Technic. The femoral artery is explored and a wide-lumen polyethylene catheter with a special soft teflonized spring wire stylet is introduced into the ascending portion of the arch of the aorta. The stylet itself is advanced about 2 inches beyond the tip of the catheter, which has a double curvature directing the spring toward the aortic valve. The

through a wide lumen, six-hole catheter lessens the tendency to produce extrasystoles and does not affect the pressure in the left ventricle.

Anteroposterior and lateral film studies are made, with four or five exposures per second, commencing at the onset of injection. After the roentgenograms are completed, the pressure of the left ventricle and pressure changes across the aortic valve are measured to determine the presence of aortic stenosis. To exclude aortic insufficiency, an additional injection of 25 to 30 c.c. with an end-hole closed catheter is made just above the sinus of Valsalva.

Interpretation. In several cases of pure mitral stenosis there was no opacification of the left atrium. In cases of mitral insufficiency the opaque medium

accumulated in the left atrium, staining it more densely than the left ventricle and aorta. Some of these diagnoses have been proved at surgery.

We feel that the degree of opacification of the left atrium correlates directly with the degree of mitral insufficiency present. This procedure also has the advantage of showing the actual size of the left ventricle.

Animals having artificially created mitral lesions were used for the initial studies. On the basis of

the results, 18 patients with rheumatic valvular disease have now been examined without harmful effects.

¹ From the University of Minnesota Hospitals, Minneapolis, Minn. (K. A., Instructor, Department of Radiology; R. E., Fellow in Cardiac Surgery; R. G. L., Assistant Professor of Radiology; C. W. L., Professor of Surgery; A. L., Fellow in Radiology.) This work was supported in part by a grant from the Minnesota Heart Association.



NATIONAL COMMITTEE ON RADIATION PROTECTION AND MEASUREMENTS

Announcement of New Publications and of Work in Progress

Safe Handling of Bodies Containing Radioactive Isotopes (A Guide for Surgeons, Pathologists, and Funeral Directors), National Bureau of Standards Handbook 65, issued July 10, 1958,¹ is a modified version of Handbook 56, *Safe Handling of Cadavers Containing Radioactive Isotopes*, published in 1953, and includes new information as well as the revised maximum permissible radiation exposure levels developed since then.² Pertinent information is given for the guidance of mortuary and medical personnel involved in the handling and autopsy of bodies containing radioactive materials. Individuals performing emergency surgery or autopsy on bodies which have received large internal therapeutic doses of a radioactive isotope are subject to radiation exposure; the Handbook discusses the reduction of this occasional exposure to the permissible level. The report indicates that, at least for the next few years, highly radioactive bodies will be encountered only rarely. The body must be adequately tagged so that radiation danger will be recognized by the surgeon or embalmer. Risk depends largely on the relative location of the isotope and the operative site, on how large a dose the patient received, and how recently. Separate sections deal with analysis of extreme cases both with and without opening of the body for surgery or autopsy, accident or injury during surgery or autopsy, contaminated clothing and instruments, cremation, and method of dosage calculation.

Addendum to Report on Protection Against Radiations from Radium, Cobalt-60, and Cesium-137 (National Bureau of Standards Handbook 54).³ A full revision of Handbook 54 is now in preparation. Until this is completed, and in order to bring the present Handbook into conformance with the new maximum permissible radiation levels,² a two-page

addendum to Handbook 54 has been issued. The changes relate to the new permissible levels, the design of teletherapy apparatus, and radiation hazards resulting from fire.

Consideration of Exposures Under Emergency Conditions. Subcommittee 14, "Permissible Exposure Dose Under Emergency Conditions," has been working for several years in an endeavor to develop an adequate picture of the effect of high doses of radiation that may be received by large groups of people under emergency or disaster conditions (such as nuclear warfare or the disruption of a large reactor). Doses being considered by this subcommittee are not being regarded as permissible. The report, however, is intended to outline the effects to be expected from large exposures. In the event of nuclear warfare, the prime consideration of the population will be immediate survival and therefore large doses may have to be accepted without regard to long-range effects. It is hoped that the Handbook when completed will provide some guidance for the policy decisions that will have to be made under emergency conditions. The program of this committee was started under the acting chairmanship of L. S. Taylor. The permanent chairman is now Dr. George Leroy, Billings Hospital, University of Chicago, Chicago, Ill.

¹ Obtainable from Superintendent of Documents, Government Printing Office, Washington 25, D. C., at prepaid cost of 15 cents.

² Addendum to National Bureau of Standards Handbook 59, obtainable on request from Publications Section, National Bureau of Standards, Washington 25, D. C.; or see *Radiology* 71: 263, 1958.

³ Holders of Handbook 54 can secure copies of this addendum by writing to Publications Section, National Bureau of Standards, Washington 25, D. C.



EDITORIAL

Laurence L. Robbins, M.D.

President of the Radiological Society of North America



The newly installed President of the Radiological Society of North America, Dr. Laurence L. Robbins, is one of the youngest men to hold this distinguished office in recent years, yet he brings to it a wealth of experience and a background of distinguished accomplishments in radiology rarely acquired by men years his senior.

Larry Robbins was born in a parsonage in Burlington, Vermont, forty-seven years ago and received his early schooling in his native state. He attended Ohio-Wesleyan College and took his B.S. and M.D. degrees from the University of Vermont. A rotating internship at the Mary Fletcher Hospital preceded his training

in radiology, which was begun at that hospital under Dr. A. B. Soule, Jr., and completed in 1941 under Dr. George W. Holmes at the Massachusetts General Hospital. Immediately following completion of his residency he was appointed staff radiologist and in 1946 succeeded to the position of Radiologist-in-Chief at the Massachusetts General Hospital. He is an associate clinical professor of radiology in the Harvard Medical School.

During the years Larry has acquired many honors for himself and radiology. He has held the office of President of the New England Roentgen Ray Society; he is the Vice-President of the American Board of Radiology, a member of the Board of Chancellors of the American College of Radiology, a member of the Editorial Board of RADIOLOGY, and now President of the Radiological Society of North America. He is a member of and holds office in many other societies. He served his Alma Mater (University of Vermont) as a member of the Board of Trustees for a period of six years.

Dr. Robbins has contributed many and varied articles to the radiological literature, but his best known work is the textbook

Roentgen Interpretation written in conjunction with Dr. George W. Holmes, now in its eighth edition.

Perhaps his greatest contribution to radiology lies not in the achievements listed above but in his successful training of future radiologists. Since he became Radiologist-in-Chief at the Massachusetts General Hospital, many young men and women, including some of today's outstanding younger radiologists, have graduated from the Department of Radiology.

His other interests are centered around his family and his charming 18th century farm house in New Hampshire, where he spends his summers and spare moments with his wife Ruth and three children—Dick, Carol, and Janice. Tempting fish to take a fly occupies what little time he has left.

He brings to the office of President of the Radiological Society of North America catholicity of interest, boundless energy and vigor, fine judgment and ability not given to many. American radiology can well be proud of him, and the Society assured that it has chosen well.

STANLEY M. WYMAN, M.D.

MILFORD D. SCHULZ, M.D.

Forty-Fourth Annual Meeting

The Forty-fourth Annual Meeting of the Radiological Society of North America, held in Chicago, at the Palmer House, Nov. 16-21, 1958, exceeded in point of attendance even the record-breaking meeting of 1957, the total registration passing the 3,000 mark. From the standpoint of educational value and general interest, also, the meeting was outstanding. The program arranged by the President, Dr. Leo G. Rigler, and his committee was presented in two sections, A and B, meeting simultaneously each morning, Tuesday through Friday, and joining in a combined session each afternoon. A third section, C, for the presentation of brief papers on current work in the field of radiological physics met on Wednesday afternoon.

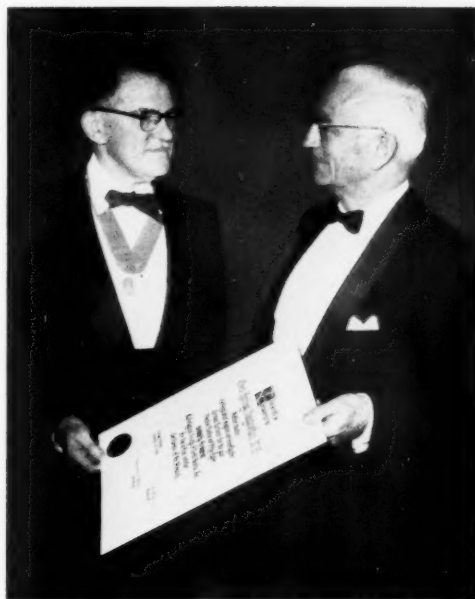
The Refresher Course series, in its twentieth year, opened on Sunday; all of Monday morning was devoted to this part of the program and it was continued with courses from 8:30 to 10:00 each morning for the remainder of the meeting. Included as refresher courses were the Therapy Information session on Sunday afternoon, with Dr. Vincent P. Collins as Moderator, and the ever-popular Film Reading Session which filled the ballroom of the hotel Sunday evening. Many instructive cases were demonstrated. Dr. L. Henry Garland was Moderator and the panel of experts included Dr. Wendell G. Scott, Dr. Bernard J. O'Loughlin, and Dr. Alfred S. Berne.

The meeting was formally opened at 2:00 P.M. Monday. A splendid address of

greeting was brought by Dr. Warren W. Furey, whose sudden death later in the week injected an unaccustomed note of sadness in the proceedings. Dr. Leo G. Rigler gave the presidential address—A Critique of Roentgen Interpretation—following which Dr. W. Walter Wasson introduced Dr. Douglass H. Howry, who delivered the Memorial Fund lecture on Ultrasound, a New Diagnostic Tool. A Symposium on the Use of Isotopes in Diagnosis, arranged by Dr. Hymer L. Friedell of Cleveland, occupied the remainder of the afternoon.

Section A on Tuesday morning was devoted to papers on diagnosis, a number of which concerned lesions of the central nervous system. At the same time Section B was enjoying a Symposium on Radiation Biology, a subject currently in the forefront of scientific interest. The combined section on Tuesday afternoon considered a matter which has always been of interest to radiologists, namely, Radiation Hazards—Fact or Fancy. This program, arranged by Dr. Laurence L. Robbins, attracted a large audience.

Two Symposia were presented on Wednesday morning: Cinefluorography in Medical Practice in Section A and Radiological Physics in Section B. The first of these, arranged by Dr. Herbert M. Stauffer of Philadelphia, brought out many of the newer cinefluorographic techniques, with particular reference to the development and use of apparatus for this technically difficult procedure. Attention was called to some of the pitfalls to be guarded against, as well as to the great advantages to be gained. The Section B program, as was to be expected, attracted chiefly the physicists and therapists. One of the features of the Wednesday afternoon session was a Clinic on Basic Principles in the Diagnosis of Chest Diseases, arranged by Dr. Benjamin Felson of Cincinnati. On this afternoon also recent advances in radiological physics were brought before Section C under the direction of Dr. Harold O. Wyckoff. The papers presented concerned chiefly work in progress and appear



Dr. Wangenstein receiving scroll from President Leo G. Rigler, M.D., following the Carman Lecture.

under that heading in the January 1959 issue of RADIOLOGY.

Section A on Thursday morning represented something of an innovation. The program was made up of a series of short papers (ten minutes each) on clinical subjects. These were of great value and interest, focusing attention upon current research rather than completed work. In Section B, Mr. Lauriston S. Taylor presided over a Symposium on Radiation Dosimetry. The afternoon session on Thursday included both diagnosis and therapy. One of the featured papers was by Dr. Alan S. Johnstone of Leeds, England, on the Radiological Anatomy of the Esophagogastric Junction.

Friday saw the last of the scientific sessions. Section A heard a valuable Symposium on Cardiovascular Roentgen Diagnosis, which attracted an unusually large audience. At the same time papers on therapy and diagnosis were presented before a combined session of Sections A and B. Among the contributions to this program was a paper on the Blood Supply



Dr. Robert R. Newell receiving from Dr. Rigler the Gold Medal of the Society for outstanding achievement in the field of radiology.

of the Kidney by Dr. C. J. Hodson of London.

As at the 1957 meeting of the Society, the banquet was dispensed with and the evening formerly devoted to this feature was taken for the Carman Lecture. This was delivered by Dr. Owen H. Wangenstein of Minneapolis, who spoke with the authority of long experience and intensive study on Carcinoma of the Stomach. At the conclusion of his address, he was presented with an illuminated scroll as a memento of the occasion. At this time, also, the Gold Medal of the Society was bestowed upon Dr. Robert R. Newell of San Francisco for his outstanding contributions to radiology and particularly his more recent work on radiobiology. In response Dr. Newell, in his inimitable manner, expressed his appreciation of this high honor.

As his closing official act as President, Dr. Rigler presented the Pfahler gavel to Dr. Laurence L. Robbins, the incoming President, and received at his hands an

illuminated scroll commemorating the term of office just completed.

The new officers of the Society were announced, as follows:

President-Elect, Theodore J. Wachowski, M.D., Wheaton, Ill.; First Vice-President, Benjamin Felson, M.D., Cincinnati, Ohio; Second Vice-President, Alfred M. Popma, M.D., Boise, Idaho; Third



Dr. Laurence L. Robbins (left), incoming President, and Dr. Theodore J. Wachowski (right), President-Elect.

Vice-President, David S. Carroll, M.D., Memphis, Tenn.; Secretary-Treasurer, Donald S. Childs, M.D., Syracuse, N. Y.; Historian, Howard P. Doub, M.D., Detroit, Mich.; Member of Board of Directors, Robert P. Barden, M.D., Philadelphia, Penna.

Announcement was also made of the winners of awards for scientific exhibits. No account of the meeting would be complete without reference to this feature. More than fifty exhibits attracted wide attention and offered much of educational value. The Case of the Day, as usual, produced the most comments. There were

38 double winners, 8 triple winners, and one grand champion, who got all four cases right. Interestingly enough, this last was a third-year resident from Jackson Memorial Hospital, Miami, Fla., Dr. William L. Wall. The awards were as follows:

Clinical Investigation

Magna Cum Laude. Chronic Bronchitis and Emphysema at Bronchography. ATIS K. FREDMANIS, M.D., W. MOLNAR, M.D., and T. R. FRYE, M.D., Columbus, Ohio.

Cum Laude. Subcutaneous Ossification of the Legs. HEINZ I. LIPPMANN, M.D., and RALPH R. GOLDIN, M.D., New York, N. Y.

Certificate of Merit. Hypertrophic Cholecystitis. ALBERT JUTRAS, M.D., MARCEL LONGTIN, M.D., and HENRI-P. LEVESQUE, M.D., Montreal, Canada.

Honorary Mention. Arteriography in Bone and Soft Tissue Tumors. RU-KAN LIN, M.D., ELLIOTT C. LASSER, M.D., and HERSCHEL C. MOSS, M.D., Buffalo, N. Y.

Fundamental Investigation

Magna Cum Laude. Induced Cardiac Arrest as an Aid to Contrast Cardiovascular Visualization. LOUIS H. FRISCHE, M.D., and CHARLES T. DOTTER, M.D., Portland, Ore.

Cum Laude. Radiation-Induced Dysplasias of

Bone. PHILIP RUBIN, M.D., J. ROBERTS ANDREWS, M.D., RICHARD L. SWARM, M.D., and LUCY F. SQUIRE, M.D., Rochester, N.Y.

Certificate of Merit. Opacifying Gallstones. EMANUEL SALZMAN, M.D., ROBERT P. SPURCK, M.D., LAWRENCE C. KIER, M.D., and DAVID H. WATKINS, M.D., Denver, Colo.

Honorary Mention. Experimental Lymphadenopathy and Lymphangiography. HARRY W. FISCHER, M.D., Iowa City, Iowa.

Special Award. A Model for Teaching Basic Electrical Physics. LINNEUS G. IDSTROM, M.D., Minneapolis, Minn.

In this brief account, only the high lights of a memorable meeting could receive attention. The entire program was of a high standard of excellence, the attendance at all sessions was most gratifying, and expressions of satisfaction were heard from many sources. The Refresher Courses especially were most popular and for a number of them tickets were at a premium even on the first day. The large number of younger radiologists present augurs well for the future of our Society.

Dr. Rigler deserves great credit for a task well done.



ANNOUNCEMENTS AND BOOK REVIEWS

NINTH INTERNATIONAL CONGRESS OF RADIOLOGY

More than 1,000 radiologists are expected to attend the Ninth International Congress of Radiology in Munich, July 23-30, 1959. The meeting will be under the patronage of Prof. Dr. Theodor Heuss, *Bundespräsident*. Professor H. Holthusen, Hamburg, is Honorary President of the Congress, Professor Boris Rajewsky, Frankfurt, is President, and Professor H. von Braunbehrens, Munich, is the General Secretary. The sessions will cover the various aspects of roentgen diagnosis and therapy, including image amplification, protection measures, and the chemical and biologic effects of radiation.

In connection with the Congress, a new section of the Deutsche Röntgen-Museum in Remscheid-Lennep will be dedicated.

For those who can take only the month of July for travel, Drs. John A. Evans, Nathaniel Finby, and Robert H. Freiburger have arranged a Charter Flight to Europe for the purpose of attending the Congress. A KLM aircraft accommodating 60 persons will leave New York on July 1 and return from Munich on July 31; the price is \$350.00 per person, round trip. Inquiries should be addressed immediately to Robert H. Freiburger, M.D., 535 East 70th St., New York 21, N. Y., or to Tradewinds Travel, Inc., 575 Lexington Ave., New York.

CENTRAL OHIO RADIOLOGICAL SOCIETY

Newly elected officers of the Central Ohio Radiological Society, all of Columbus, are: Arthur R. Cohen, M.D., President; Dale E. Putnam, M.D., Vice-President; William B. Schwartz, M.D., 1500 W. Third Ave., Columbus 12, Secretary-Treasurer.

GREATER CINCINNATI RADIOLOGICAL SOCIETY

The Greater Cincinnati Radiological Society recently elected the following officers for the ensuing year: President, Roland Wintzinger, M.D.; Vice-President, Warner A. Peck, Jr., M.D.; Secretary-Treasurer, John E. Singer, M.D., 19 Garfield Place, Cincinnati 2.

NEBRASKA STATE RADIOLOGICAL SOCIETY

The following officers were recently elected by the Nebraska State Radiological Society: President, Dale H. Davies, M.D., Omaha; President-Elect, Shaun D. Gunderson, M.D., also of Omaha; Secretary-Treasurer, Warren Quinton Bradley, M.D., 206 S. 13th St., Lincoln 8.

THE SOUTHWESTERN SOCIETY OF NUCLEAR MEDICINE

The Southwestern Society of Nuclear Medicine will hold its fourth annual meeting at the Roosevelt Hotel in New Orleans, La., March 14-15, 1959. Officers of the Society are: Herbert C. Allen, Jr., M.D., Houston, Texas, President; Peter E. Russo, M.D., Oklahoma City, Okla., President-Elect; Samuel B. Nadler, M.D., New Orleans, La., First Vice-President; David W. Gould, M.D., Little Rock, Ark., Second Vice-President; J. R. Maxfield, Jr., M.D., 1719 Pacific Ave., Dallas 1, Texas, Secretary and Treasurer.

HEALTH PHYSICS SOCIETY

The Health Physics Society will hold its fourth annual meeting June 18-20, 1959, in Gatlinburg, Tenn. This organization numbers 1,100 professional health physicists in the United States and abroad. Lauriston S. Taylor is the President, and other officers are Elda E. Anderson, President-Elect; J. W. McCaslin, Secretary; Robert G. Gallagher, Treasurer.

SOCIEDAD COLOMBIANA DE RADIOLOGÍA

At a recent meeting the Sociedad Colombiana de Radiología elected the following officers: President, Alberto Torres Focke; Vice-President, Carlos Monsalve Arboleda; Secretary, Alberto Mejía Diazgranados, Apartado Aereo No. 5804, Bogotá; Treasurer, Eduardo Ricaurte Medina; Librarian, Armando Uribe Alvarez.

NATIONAL BUREAU OF STANDARDS NEW CIRCULAR

The National Bureau of Standards Circular 594, *Preparation, Maintenance, and Application of Standards of Radioactivity*, by W. B. Mann and H. H. Seliger, may now be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. This publication reviews the methods available for the preparation of both primary and secondary standards of radioactivity. In addition, the applications of these standards to problems in physics are discussed. The results of international comparisons of radioactivity standards that have been made in the past five years are summarized in one section.

The 47-page pamphlet may be purchased for 35 cents in the United States. Foreign remittances must be in U. S. exchange and should include an additional one-fourth of the publication price to cover the mailing costs.

UNIVERSITY OF CALIFORNIA COURSES

The University of California at Los Angeles will present a two-day symposium on Diagnostic Radiology of the Digestive Tract, March 20-21, 1959. The program will consist of a day and a half of didactic material and a half-day session of clinical demonstrations with patients. The course chairman will be Dr. Bernard J. O'Loughlin and the co-chairman Dr. Joseph L. Westover, both of the staff of the UCLA School of Medicine. There will be two distinguished guest speakers: Dr. Allan S. Johnstone of Leeds, England, and Dr. F. E. Templeton of Seattle, Wash. The fee for the course is \$60.00, payable to the Regents of the University of California. Requests for information should be sent to the Department of Continuing Education in Medicine, University of California Medical Center, Los Angeles 24, Calif.

A five-day course on Diagnostic Radiology is scheduled for March 20-24, 1959, at the University of California Medical Center in San Francisco. Guest speakers will be Felix Fleischner, M.D., Harvard Medical School, Benjamin Felson, M.D., of Cincinnati, John Hope, M.D., of Philadelphia, and Leo G. Rigler, M.D., of Los Angeles.

After the first day, the course will be divided into all-day programs on the chest, gastrointestinal tract, skeletal system, and urogenital tract. The fee is \$80.00, or \$20.00 per day. A descriptive brochure and application for enrollment may be obtained from Seymour M. Farber, M.D., Continuing Medical Education, University of California Medical Center, San Francisco 22, Calif.

UNIVERSITY OF CINCINNATI REFRESHER COURSE IN DIAGNOSTIC ROENTGENOLOGY

During the week beginning June 15, 1959, the second annual Refresher Course in Diagnostic Roentgenology will be held at the Cincinnati General Hospital. The course will cover various aspects of diagnostic roentgenology, and instruction will be given exclusively by members of the Radiology Staff. Enrollment is limited to radiologists and radiology residents, and tuition is \$150.00. Further information and application forms may be obtained from Dr. Benjamin Felson, X-Ray Department, Cincinnati General Hospital, Cincinnati 29, Ohio.

FREEDMAN LECTURES, UNIVERSITY OF CINCINNATI

On Saturday and Sunday, April 11 and 12, 1959, Dr. H. O. Peterson, Professor and Director of the Department of Radiology, University of Minnesota Medical School, will deliver the 11th Annual Joseph and Samuel Freedman Lectures in Diagnostic Radiology at the University of Cincinnati

College of Medicine. Radiologists desiring to attend are requested to write Dr. Benjamin Felson, X-Ray Department, Cincinnati General Hospital, Cincinnati 29, Ohio, for further details. There will be no charge for the lectures.

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

SURFACE AND RADIOLOGICAL ANATOMY FOR STUDENTS AND GENERAL PRACTITIONERS. By A. B. APPLETON, W. J. HAMILTON, and IVAN C. C. TCHAPEROFF. Fourth edition by W. J. HAMILTON, M.D., D.Sc., F.R.S.E., Professor of Anatomy in the University of London at Charing Cross Hospital Medical College, sometime Regius Professor of Anatomy in the University of Glasgow, formerly Professor of Anatomy in the University of London at the Medical College of St. Bartholomew's Hospital, and G. SIMON, M.D., B.Ch., D.M.R.E. (Cantab.), F.F.R., Demonstrator of Radiological Anatomy in the Medical College of St. Bartholomew's Hospital and Radiologist to the Diagnostic X-ray Department, St. Bartholomew's Hospital, and to the Brompton Hospital, London. A volume of 356 pages, with 416 figures. Published by The Williams & Wilkins Co., Baltimore, Md., 1958. Price \$9.50.

X-RAY DIAGNOSIS OF THE ALIMENTARY TRACT IN INFANTS AND CHILDREN. By EDWARD B. SINGLETON, M.D., Director of Radiology, Texas Children's and St. Luke's Hospitals, Houston, Texas; Clinical Assistant Professor of Radiology, Baylor University College of Medicine; Clinical Associate Radiologist, University of Texas Post Graduate School. A volume of 352 pages, with 215 figures. Published by the Year Book Publishers, Inc., Chicago, Ill., 1959. Price \$11.00.

THE YEAR BOOK OF RADIOLOGY (1958-1959 YEAR BOOK SERIES). RADIOLOGIC DIAGNOSIS. Edited by JOHN FLOYD HOLT, M.D., Professor, Department of Radiology, University of Michigan, and FRED JENNER HODGES, M.D., Professor and Chairman, Department of Radiology, University of Michigan. RADIATION THERAPY. Edited by HAROLD W. JACOX, M.D., Professor of Radiology, College of Physicians and Surgeons, Columbia University; Chief, Radiation Therapy Division, Radiologic Service, Presbyterian Hospital, New York City, and MORTON M. KLIGERMAN, M.D., Professor of Radiology and Chairman of the Department of Radiology, Yale University

School of Medicine; Director of Radiology, Grace-New Haven Community Hospital. A volume of 448 pages, with 336 figures. Published by the Year Book Publishers, Inc., Chicago, Ill., 1958. Price \$10.00.

TREATMENT OF CANCER AND ALLIED DISEASES. VOLUME II: TUMORS OF THE NERVOUS SYSTEM BY THIRTY AUTHORS. Edited by GEORGE T. PACK, M.D., F.A.C.S., Attending Surgeon, Memorial Center for Cancer and Allied Diseases; Clinician, Sloan-Kettering Institute for Cancer Research; Associate Professor of Clinical Surgery, Cornell University Medical College; Surgeon, Pack Medical Group, New York; and IRVING M. ARIEL, M.D., F.A.C.S., Associate Clinical Professor of Surgery and Associate Attending Surgeon, New York Medical College, Flower and Fifth Avenue Hospitals; Surgeon, Pack Medical Group, New York. A volume of 316 pages, with 340 figures. Published by Paul B. Hoeber, Inc., Medical Book Department of Harper & Brothers, New York, N.Y., 2d ed., 1959. Price \$15.00.

NUCLEAR EXPLOSIONS AND THEIR EFFECTS. Foreword by Jawaharlal Nehru. A volume of 340 pages, with 4 charts, 1 map, and numerous tables. Published by the Publications Division, Ministry of Information and Broadcasting, Government of India, Old Secretariat, Delhi-8, India, 2d ed., 1958. Price \$4.00.

THE ATOM AND THE ENERGY REVOLUTION. By NORMAN LANSDELL. A volume of 200 pages, with 32 plates. Published by Philosophical Library, Inc., New York, N. Y., 1958. Price \$6.00.

TECHNIQUE RADIOLOGIQUE: GUIDE DU MANIPULATEUR; THÉORIE ET PRATIQUE. By J. REBOUL, Professeur de clinique électro-radiologique à la Faculté de Médecine de Bordeaux; R. GUICHARD, Electro-radiologiste des hôpitaux de Bordeaux; CH. WANGERMEZ, Ancien professeur à la Faculté de Médecine, Radiologiste des hôpitaux de Bordeaux; J. DUHAMEL, Professeur agrégé de Physique médicale, à la Faculté de Médecine de Bordeaux; G. DELORME, Assistant d'électro-radiologie des hôpitaux de Bordeaux, Professeur agrégé d'électroradiologie à la Faculté de Médecine. Preface by Dr. Aujaleu, Directeur général de la Santé Publique. A monograph of 216 pages, with 158 figures. Published by Masson & Cie, 120, Boulevard St.-Germain, Paris 6^e, 1958. Price 2,400 francs.

ERGEBNISSE DER GESAMTEN TUBERKULOSE- UND LUNGENFORSCHUNG. BAND XIV. Edited by ST. ENGEL, London; L. HEILMEYER, Freiburg i.

Br.; J. HEIN, Tönsheide; and E. UEHLINGER, Zürich. A volume of 736 pages, with 462 illustrations on 283 figures. Published by Georg Thieme Verlag, Herdweg 63, (14a) Stuttgart, Germany, 1958. Distributed in the U. S. A. and Canada by Intercontinental Medical Book Corporation, New York 16, N. Y. Price DM 144.—(\$34.30).

LEITFADEN DES STRAHLENSCHUTZES FÜR NATURWISSENSCHAFTLER, TECHNIKER UND MEDIZINER. By Dr. med. HANS R. BECK, Facharzt für Radiologie, Lehrbeauftragter für Strahlenschutz am Badischen Staatstechnikum, Karlsruhe; Dr. rer. nat. HANS DRESEL, Diplomphysiker, Radiologisches Institut der Universität Freiburg/Br.; and Dr. med. HANS-JOACHIM MELCHING, Facharzt für Radiologie, Radiologisches Institut der Universität Freiburg/Br. With a foreword by Prof. Dr. H. Langendorff, Freiburg/Br. A volume of 254 pages, with 100 figures and 18 tables. Published by Georg Thieme Verlag, Herdweg 63, (14a) Stuttgart, Germany, 1959. Distributed in U. S. A. and Canada by Intercontinental Medical Book Corporation, New York 16, N. Y. Price DM 36.—(\$8.60).

Book Reviews

HEMOPHILIC ARTHROPATHIES. By HENRY H. JORDAN, M.D., Orthopaedic Surgeon, Lenox Hill Hospital, Chief of Hemophilia Clinic, Lenox Hill Hospital, O.P.D., New York City; Consulting Orthopaedic Surgeon, Manhattan State Hospital; Orthopaedic Surgeon, National Hemophilia Foundation. A volume of 256 pages, with 64 figures. Published by Charles C Thomas, Springfield, Ill., 1958. Price \$8.50.

An intensive study of 56 patients with hemophilic arthropathies provided the author with material for his survey of this important aspect of hemophilia. The work was done at Lenox Hill Hospital, New York City, with the cooperation of the National Hemophilia Foundation.

The subject is treated with special reference to rehabilitation, with chapters on cast technics, orthopedic appliances, and the general care of the patient. More than half the book is devoted to case histories; 21 cases are fully presented and 35 are abstracted. A short bibliography is appended.

This book will be of particular interest to orthopedists and those dealing with arthritis. A chapter on roentgenology commends it to radiologists as well.

ORAL ROENTGENOGRAPHIC DIAGNOSIS. By Edward C. STAFNE, D.D.S., F.A.C.D., Senior Consultant, Section of Dentistry and Oral Surgery, Mayo Clinic, and Professor of Dentistry and Oral Surgery, Mayo Foundation, Graduate

School, University of Minnesota, Rochester, Minn. A volume of 304 pages, with 1,338 illustrations on 423 figures. Published by W. B. Saunders Company, Philadelphia, 1958. Price \$14.50.

Through his association with the Mayo Clinic, the author of this volume has had at his disposal a large number of roentgenograms made in the department of dentistry and oral surgery on patients with systemic disease as well as on those with purely oral lesions. Both groups are covered in this work.

The first five chapters are devoted to the normal anatomy and abnormalities of the teeth. A sixth chapter deals with dental caries, while others cover diseases and abnormalities of the jaws and the secondary effects which these produce upon the teeth; the effects of irradiation on the teeth and supporting structures, a subject which gains importance in view of the present accent on protection; the manifestations of a variety of systemic conditions on dental films; and postoperative studies. Several chapters are given over to cysts and tumors of the jaws, including fibro-osseous lesions.

The book is well illustrated throughout with roentgenograms reproduced in the negative phase. A list of well chosen references is appended to each chapter.

This text will be of great interest to radiologists and students as well as to dentists and oral surgeons.

THE PRACTICE OF NUCLEAR MEDICINE. By WILLIAM H. BLAHD, M.D., Chief, Radioisotope Service, Veterans Administration Center, Los Angeles, California; Assistant Clinical Professor of Medicine, School of Medicine and Medical Physics Physician, Radiological Safety Division, University of California at Los Angeles, FRANZ K. BAUER, M.D., Chief, Outpatient Services, Los Angeles County Hospital; Associate Clinical Professor of Medicine and Co-ordinator of Radioisotope Research, University of Southern California School of Medicine; Associate Clinical Professor of Medicine, College of Medical Evangelists School of Medicine; Attending Specialist—Radioisotope Service, Veterans Administration Center, Los Angeles, Calif., and BENEDICT CASSEN, Ph.D., Chief, Medical Physics Section, Atomic Energy Project and Clinical Professor of Biophysics, University of California at Los Angeles School of Medicine; Consultant in Radioisotopes—Radioisotope Service, Veterans Administration Center, Los Angeles, Calif. Introduction by Paul Aebersold, Ph.D., Assistant Director for Isotopes and Radiation, Division of Civilian Application, United States Atomic Energy Commission. Foreword by Joseph F. Ross, M.D., Associate Dean, Professor of Medicine and Radiology, School of Medicine, University of California at Los Angeles. A volume of 408 pages, with 113

figures. Published by Charles C Thomas, Publisher, Springfield, Ill., 1958. Price \$12.50.

The use of radioactive isotopes as diagnostic and therapeutic tools in the treatment of human disease is now recognized as an important part of the medical armamentarium. This monograph represents an overall presentation of the clinical application of radioactive isotopes, suitable particularly for the student or the physician unfamiliar with the field. The several phases of the subject are covered clearly and concisely in a style that is easy to read.

The volume is divided into four parts and an appendix, and is comprehensively indexed. The first part deals with the physical principles involved in the use of radioactive isotopes, discussing first the physical aspects of the materials themselves, then the measurement of radiation, and finally the principles of isotope dosimetry. The second part is concerned with the use of radioactive isotopes in diagnostic procedures, considering first radioactive iodine in the diagnosis of thyroid disease, and then the use of radioisotopes for the localization of tumors, the determination of gastrointestinal function, and the diagnosis of abnormal cardiovascular and renal function. Procedures are presented for the determination of blood volume, and for the use of radioiron and vitamin B₁₂ labeled with Co⁶⁰ in the study of hematologic disease. A chapter on isotope dilution techniques concludes this part of the text. In the third part the therapeutic applications of various materials are considered. These include the use of I¹³¹ in the treatment of hyperthyroidism, cardiac disease, and thyroid cancer, and the treatment of malignant disease with radioactive phosphorus and radioactive colloidal gold and chromic phosphate. A section is also included on the treatment of neoplastic disease with external and implanted radioactive sources. The fourth section rather briefly discusses the organization and arrangement of the radioisotopes laboratory and the instrumentation required. Some useful tables are presented in the appendixes.

This monograph presents a good introduction to the clinical use of radioactive isotopes.

THE YEAR BOOK OF CANCER (1957-1958 YEAR BOOK SERIES). Compiled and edited by RANDOLPH LEE CLARK, JR., B.S., M.D., M.Sc., (Surgery), D.Sc. (Hon.), Houston, Texas, Director and Surgeon-in-Chief, The University of Texas M.D. Anderson Hospital and Tumor Institute; Professor of Surgery, The University of Texas Postgraduate School of Medicine; Clinical Professor of Surgery, Baylor University College of Medicine; Fellow, American College of Surgeons, and RUSSELL W. CUMLEY, B.A., M.A., Ph.D., Houston, Texas, Director of Publications, The University of Texas M. D. Anderson Hospital and Tumor Institute; Professor of Medical Journalism, The University of Texas Postgraduate School

of Medicine. A volume of 524 pages, with 191 figures. Published by The Year Book Publishers, Inc., Chicago 11, Ill., 1958. Price \$8.00.

This current volume of the *Year Book of Cancer* follows the well known year book format and organization. Because of the wide scope of this particular volume, the Editorial Board is more extensive than is true of many of the other specialized volumes of the series. The "core" of the Board consists of 19 members of the University of Texas M. D. Anderson Hospital and Tumor Institute. These, together with 105 other editors, made up 24 groups, each concerned with some field of Oncology. Each of the groups selected articles that they felt were most significant and the authors of the articles were then requested to prepare abstracts for inclusion in this volume. In this manner 235 articles were selected from a total of 4,000 published during the year.

The sections cover the major clinical types of malignant disease, pathology, and treatment methods, with several sections on experimental studies of cancer development and treatment.

The success of such a work depends, of course, on the care with which the articles are chosen. From examination of the book it seems that the articles included are representative of new and important developments in each field. In this year's volume there is somewhat more editorial comment than in earlier ones, which is of considerable help in giving perspective to the individual not acquainted with the particular field or region. More editorial comment would not be amiss, however.

CAUSATION OF CANCER. Scientific Editor: Professor E. BOYLAND. Chairman of the Committee Which Planned the Symposium: Professor ALEXANDER HADDOW. *British Medical Bulletin*, Volume 14, Number 2, May 1958, pp. 73-196, with figures and tables. Published by the Medical Department, The British Council, 65 Davies St., London, W. 1, England, 1958. Price, paper-bound, \$4.00.

This number of the *British Medical Journal* on the Causation of Cancer is made up of a symposium containing 21 review articles by 27 British contributors, both in Great Britain and the Commonwealths. It is a successor to the number on Chemical Carcinogenesis published eleven years ago (*Brit. M. Bull.* 4: No. 5-6, 1947, now out of print). It could be said to represent a compendium of current British opinion on experimental carcinogenesis. The articles are mostly rather short but with extensive bibliographies.

The greatest emphasis is given to chemical and radiation carcinogenesis but viruses and endocrine factors are also discussed. In general the emphasis is experimental, although papers are included on

some industrial and environmental influences. The articles are rather technical, and while they are of interest to those familiar with the field of experimental cancer, their clinical applicability is quite limited.

This volume represents an excellent review of current concepts regarding carcinogenesis. The bibliographies are particularly valuable.

CLINICAL USE OF RADIOISOTOPES. A MANUAL OF TECHNIQUE. Edited by THEODORE FIELDS, M.S., F.A.C.R. (Assoc.), Assistant Director, Radioisotope Service, Veterans Administration Hospital, Hines, Ill.; Instructor in Radiology, Northwestern University Medical School; Certified Medical Nuclear Physicist, American Board of Radiology, and LINDON SEED, M.D., Clinical Associate Professor of Surgery, University of Illinois College of Medicine; Director of Isotope Laboratory, Augustana Hospital, Chicago; Consultant in Radioisotopes, Veterans Administration Hospital, Hines, Ill. A volume of 456 pages, with 71 illustrations. Published by The Yearbook Publishers, Inc., 200 E. Illinois St., Chicago 11, Ill., 1957. Price \$9.50.

The clinical application of radioactive isotopes has passed the experimental stage in many fields. In this book the authors attempt to present specific recommended techniques for the accomplishment of the various accepted isotope procedures, both diagnostic and therapeutic. In their preface they emphasize that this is a manual for practical application and not a textbook containing a compilation of all known technics and variations. They have the assistance of several collaborators chosen for their particular interest and experience.

The contents are divided into four parts covering routine clinical diagnostic tests, routine clinical therapy technics, planning and operating the isotope laboratory, and a section on radiation safety. In the sections on Clinical Diagnosis and Therapy, special attention is given to exact descriptions of recommended procedures, with only minor emphasis on the selection of patients and other clinical features. The sources of error are described and the clinical significance of results of the diagnostic tests and the usefulness of the therapeutic procedures are discussed.

One of the problems facing the person who wishes to establish an isotope laboratory is licensure by the A.E.C. for procurement and handling of the materials. The section on planning and operating a radioisotope laboratory outlines the requirements, and discusses the procurement of isotopes from commercial or government suppliers. Chapters on instrumentation and facilities present a suggested design for a laboratory and fundamental instruments.

The section on radiation safety gives recommendations for clinical and laboratory personnel,

and general regulations regarding the conduct of hospital personnel in the management of isotope patients. Appendices include decay tables, sample forms, and an extensive glossary.

Examination of the procedures and technics set forth indicates that these are sound and reasonable. Extensive bibliographies are given with each section to permit further study of variations that are possible. While there may be other particular technics that would be favored by some, this book presents a well rounded program that would be helpful to anyone setting up a radioisotope laboratory.

ELEMENTS OF BIOPHYSICS. By JAMES E. RANDALL, B.S.E.E., M.S., Ph.D., Associate Professor of Physiology and Biophysics, Department of Physiology and Pharmacology, University of Missouri Medical Center. A volume of 334 pages, with figures and tables. Published by the Year Book Publishers, Inc., Chicago, Illinois, 1958. Price \$8.00.

In this text on *Elements of Biophysics*, the basic concepts of mathematics, including statistics, are described without going into the mechanics of obtaining quantitative results. For example, the reasoning back of the derivation of a formula for measuring statistical significance is given, the formula presented, and its application to biological problems suggested. Various fields in physics, such as mechanics, acoustics, and electricity are treated in the same way, with illustrations of their application to problems in biology.

In many instances, understanding of mathematical concepts is all that is necessary for the biologist or radiological resident. He does not need to carry out an integration to be able to use formulae derived by this means. The book gives an excellent introduction to this subject for medical students and first-year residents, while the general view presented would enable the more advanced student to see the relation of his detailed study to the entire field.

TRAUMATISMES ANCIENS: GÉNÉRALITÉS; MEMBRE SUPÉRIEUR. By R. MERLE D'AUBIGNÉ, Professeur de Clinique chirurgicale orthopédique et réparatrice à la Faculté de Médecine de Paris, and R. TUBIANA, Ancien Chef de Clinique chirurgicale à la Faculté de Médecine de Paris. With the collaboration of P. Boutin, L. Faulong, G. Lord, P. Masse, P. Maurer, M. Postel, J.-O. Ramadier, and O. Troisier. A volume of 440 pages, with 215 figures. Published by Masson & Cie, 120, Boulevard Saint-Germain, Paris 6^e, France, 1958. Price 5,900 francs; paper bound 5,000 francs.

This is one of a series of books by the senior author and his collaborators covering chronic diseases, orthopedic problems, and reconstructive surgery. Most of the volume deals with surgical principles,

although there are a few radiographic reproductions to show the appearance of the bones before and after different surgical procedures.

The book is divided into sections. The first section deals with general principles and technics employed in reconstructive surgery. It includes a consideration of sequelae of old injuries in bones, joints, muscles, and tendons, and also offers some general principles on re-education.

The second general section is concerned with specific sequelae of old injuries involving the upper extremities, including separate chapters on the scapula, shoulder, arm, elbow, forearm, and wrist. A final chapter is given on the re-education of the upper extremity in traumatology.

As indicated above, this book is largely of interest to orthopaedic surgeons. The contents are good, the sketches, illustrations, and reproductions of roentgenograms are excellent. However, it is doubtful if many radiologists would consider it essential to their personal libraries. As a book for reference on some particular occasion, it appears more suitable for a general library.

LE MÉDIASTIN ET SA PATHOLOGIE. By MAURICE BARIÉTY, Professeur de Clinique Médicale à l'Hôtel-Dieu, Membre de l'Académie de Médecine, and CHARLES COURY, Médecin des Hôpitaux de Paris. A volume of 854 pages, with 312 figures. Published by Masson et Cie, 120, Blvd. Saint-Germain, Paris, 6^e, France, 1958. Price 11,000 francs.

In this work the authors have probably supplied us with the most thorough treatise limited to the mediastinum in the medical literature.

A full discussion of the anatomy and physiology of the mediastinum is given. Various forms of benign and malignant tumors receive extensive consideration. The involvement of lymph nodes by inflammatory and neoplastic diseases is also presented, along with special consideration of tumors of nerves, both benign and malignant. The various inflammatory conditions involving the mediastinum, including the mediastinal pleural surfaces and the diaphragm, are also covered.

At the outset, the authors give a table listing the various diseases of the mediastinum and the number of cases they have seen, which form the basis of the text. In the various chapters combined statistics from several authorities are quoted to illustrate, for example, the relative incidence of mediastinal tumors.

The cardiovascular conditions which give rise to differential diagnostic possibilities, are included in a separate chapter.

Of interest to the radiologist is the fact that most of the figures are reproductions of roentgenograms. Even though these are positive prints they are still of considerable value.

IN MEMORIAM



HIGDON BRYANT ELKINS
1907-1958

Dr. Higdon Bryant Elkins of Iowa City, Iowa, died on Nov. 29, 1958, of acute pulmonary embolism.

Dr. Elkins received his B.S. and M.D. degrees from Washington University, St. Louis, Missouri, the latter in 1930. Following his internship at St. Luke's Hospital in St. Louis and residencies in medicine and radiology, he practiced industrial medicine in Ely, Nevada, until his entry into the

Army of the United States. From 1942 to 1946 he was radiologist at various army stations in the United States and the European Theater of Operations. On his discharge in 1946, with the rank of Major, he returned to Iowa City and the University of Iowa, where he was promoted through the academic ranks to full Professor of Radiology in 1956.

On Nov. 3, 1936, Dr. Elkins was married to Katharine Eberhardt, who, with his mother, Mrs. Sarah Elkins, survives him.

H. B., or "Himmie," as he was known to his associates and friends, was particularly interested in radiation therapy. In collaboration with Drs. H. Dabney Kerr and R. S. Flocks, he introduced the use of radioactive gold for carcinoma of the prostate, later extending its application to ovarian cancer. His intense interest in and concern for his patients was apparent to the most casual observer, and was a source of strength and comfort to those under his care.

Much of Dr. Elkins' time was spent in resident teaching, not only those in his own department but residents of other services as well. Even though ill, he continued to teach from his room in the hospital. Music and radio construction were among his outside interests.

Dr. Elkins was a diplomate of the American Board of Radiology, a Fellow of the American College of Radiology, and a member of the Radiological Society of North America, the American Roentgen Ray Society, and the American Radium Society. He was a charter member of the more recently organized Society of Nuclear Medicine. He was active on committees in the organizations with which he was affiliated and was a frequent guest examiner in therapy for the American Board of Radiology. He gave much of his time and energy to promote the aims and goals of the Iowa Division of the American Cancer Society.

Dr. Elkins was a true physician, loved and trusted by his patients, respected and esteemed by the residents and staff who were privileged to work with him, and held in honor by fellow members of his profession.

EUGENE V. VAN EPFS, M.D.



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ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Radiological Investigation in Cases of Cerebrovascular Disease. James W. D. Bull. *Brit. M. J.* 1: 795-797, April 5, 1958. (St. George's Hospital, London, England)

Ten years experience with cerebral angiography in the investigation of strokes has taught the author that the clinical diagnosis of cerebral hemorrhage, thrombosis, embolism, and subarachnoid hemorrhage is much less accurate than classical textbook descriptions imply. More accurate diagnosis is important, since some lesions (e.g., carotid artery thrombosis, intracerebral hematomas, subdural hematomas, and tumors) are amenable to surgery.

Plain skull films should always be made, though they are only occasionally helpful. Pineal displacements and calcification in aneurysms, angiomas, and tumors may be demonstrated. Pneumoencephalograms may show the location of hematomas when angiograms show only slight or no abnormality.

Subarachnoid hemorrhage, which, the author points out, "is a sign and not a diagnosis," is considered an absolute indication for angiography, if it is first found that the patient can tolerate compression of each carotid artery for ten minutes. Spasm of cerebral vessels often follows a subarachnoid hemorrhage, and contrast material may induce further spasm. If the test indicates that the circle of Willis is not functioning adequately, angiography is probably contraindicated.

Diagnoses made by bilateral carotid angiography in 250 cases of subarachnoid hemorrhage were as follows: 99 single aneurysms, 24 multiple aneurysms, 10 angiomas, 1 angioma plus aneurysm, 31 intracerebral hematomas, 2 middle cerebral artery thromboses, 79 normal. In the "normal" group, 71 vertebral angiograms revealed 3 aneurysms, 4 angiomas, and 1 hematoma. Prognosis is favorable in the cases in which the angiograms are normal.

Angiography is also helpful in clarifying the diagnosis of cerebral hemorrhage, thrombosis, and embolism, and in detecting tumors misdiagnosed as carotid artery thrombosis.

Three figures; 1 table. GARTH R. DREWRY, M.D.
Oakland, Calif.

Radiology of Cerebral Angiomas (with Special Reference to Neuro-Ophthalmology). David Sutton. *J. Fac. Radiologists* 9: 90-96, April 1958. (Maida Vale Hospital for Nervous Diseases, London, W. 9, England)

Although cerebral angiomas were once considered to be rare lesions, the widespread use of arteriography has clearly shown them to be, in fact, of frequent occurrence. Two types of abnormality may be seen on plain radiographs of the skull: (1) Abnormal meningeal vascular channels in the cranial vault were recognized in 15 of 120 cases. These channels are often bilateral and widespread, and may be associated with enlargement of the foramen spinosum. Although meningiomas, also, may produce enlarged channels, these are usually unilateral and converge upon the site of the tumor, which is often parasagittal in location. (2) Pathognomonic calcification was present in 15 per cent of the author's series. Typically, there is speckled calcification or scattered flecks of calcification in the area of the lesion; linear

flecks, when present, resemble atheromatous plaques. Occasionally, ring-like calcifications occur in the walls of aneurysmal dilatations in the malformation. It is unusual to see solitary ring shadows except in calcified aneurysms in the region of the circle of Willis.

Adequate investigation of cerebral angiomas frequently requires bilateral carotid arteriography, and in many cases vertebral arteriography in addition. The angiographic features demonstrated in the case of a large angioma situated in one cerebral hemisphere may include (1) hypertrophied arteries leading to the angioma from a hypertrophied main vessel such as the middle cerebral artery, in turn fed by a hypertrophied ipsilateral internal carotid artery, and (2) diversion of blood across the midline through hypertrophied anterior cerebral and anterior communicating vessels from the contralateral internal carotid to supply the lesion on the opposite side. Those vessels not supplying the angioma appear relatively tiny and hypoplastic. Some angiomas, when situated entirely in the posterior fossa or when their size is small and contribution from the carotid is negligible, will be demonstrated only by vertebral arteriography. When the posterior cerebral artery supplies an angioma, it is usual for the latter to be filled equally by both the carotid and vertebral arteries. Commonly only one vertebral artery, together with the basilar artery, hypertrophies in posterior lesions, the other vertebral artery remaining relatively small. Veins draining the angioma may reach gigantic proportions and may become the site of ring calcification.

Early opacification of the venous drainage is an important feature, occurring prior to the normal venous phase of the arteriogram. Visualization of a dilated vein during the arterial phase suggests the presence of an angioma, especially the small, less typical lesion. These small angiomas frequently are manifested by subarachnoid hemorrhage or rupture into the brain substance, with formation of cerebral hematomas. Clotting may then occur in the lesion, thus causing marked difficulty in diagnosis by arteriography. The arteriogram under these circumstances may show only evidence of a local space-occupying lesion, and even at operation the angioma can be missed.

Air studies are necessary in only rare instances. Pneumography will demonstrate large malformations if the latter produce deformity of the ventricular system. Smaller lesions may protrude into the ventricular system, and intracerebral hemorrhage may produce deformity of the ventricles by occupying significant space within the brain substance.

The most important lesions to be differentiated from angiomatous malformations are (1) vascular malignant glioma, (2) hemangioblastoma, and (3) vascular metastases. The clinical features and history are usually sufficient for differentiation. The parallel lines of calcification seen in Sturge-Weber syndrome are actually in the surface of the atrophic brain tissue, which has a relatively poor blood supply.

A small number of patients with cerebral angioma may present with primarily ophthalmologic signs such as field defects, periodic migraine headaches with visual aura, papilledema, pulsating exophthalmos, and defects of ocular movement.

Twenty roentgenograms.

SAMUEL B. HAVESON, M.D.
University of California, S. F.

An Improved Technique for Testing the Effect of Contrast Media and Other Substances on the Blood-Brain Barrier. Oskar Steinwall. *Acta radiol.* **49**: 281-284, April 1958. (Neurologic Department, University of Gothenburg, Sweden)

A convenient way to study the damaging effect of a compound upon the blood-brain barrier is to introduce a solution of the substance into a vascular region which is emptied of blood during the test. The exact active concentration is then known and there are no reactions between the blood and the substance, the effect of which may be hard to judge. Broman and Olsson described a method based on these principles (*Acta radiol.* **30**: 326, 1948. *Abst. in Radiology* **53**: 624, 1949). In an attempt to duplicate their technic in rabbits the author found that it could be improved by a simple modification.

In the original technic the solution to be tested is injected into the ligated common carotid artery in a cranial direction at a pressure which expels the blood from the vessels of the ipsilateral hemisphere as long as the fluid is being injected. This can be controlled by inspecting the pial vessels through a trephine opening.

The author states that in the rabbit, as in man, the hemisphere is supplied with carotid blood exclusively by the internal carotid artery. The injection is performed just below the origin of this fine vessel from the common carotid artery. Only a small amount of the injected fluid, however, goes to the brain *via* the internal carotid artery, and the flow is apt to be impeded when the animal's head is twisted for inspection of the trephine opening over the hemisphere. To obviate these disadvantages, the external carotid artery is ligated directly cranial to the origin of the internal branch, as are also small vessels running to the neck from the internal artery or nearby parts of the common carotid. This forces all the injected fluid into the vessels of the hemisphere, and the injection can be performed much more slowly, and with only about one-tenth the amount of material, than when the external branches are patent. In a number of experiments it was shown that the injection pressure kept close to the pressure of the blood.

Barrier damage was defined as an impairment in the barrier mechanism which normally hinders trypan blue from passing from the blood out into the surrounding brain tissue. The author reproduces in tabular form a listing of experiments with Diodone (Umbradil, Diodon) and acetrizate (Reopak, Triurol). He found the lowest concentrations causing barrier damage to be approximately half the corresponding limits given by the authors mentioned. Barrier damage was demonstrated with 17.5 per cent, 20 per cent and 25 per cent Diodone when injected in twenty to forty seconds in different experiments.

I. MESCHAN, M.D.

Bowman Gray School of Medicine

Hydatid Disease of the Brain with Unusual Radiographic Appearances Following the Use of Both Negative and Positive Contrast Media. A. Kessler and R. Lipschitz. *J. Fac. Radiologists* **9**: 106-107, April 1958. (Baragwanath Hospital, Johannesburg, Union of South Africa).

The authors report a case of hydatid cyst in a 9-year-old Bantu girl seen in a mission hospital with right leg weakness of a day duration. There was no history of epilepsy. Vital signs were normal and there was a low-grade fever. Examination of the cranial nerves, as well as of the spinal fluid, indicated increased intracranial

pressure. Radiographs of the chest and skull were normal.

The ventricular system did not fill at encephalography, and bilateral frontal ventricular catheterization was therefore done. This caused a right-sided jacksonian attack. A ventriculogram revealed a grossly dilated ventricular system and demonstrated an 11 × 10 × 9-cm. cystic lesion in the left frontal area, which was filled with a large number of grape-like protrusions. One cubic centimeter of Myodil was introduced into the cyst and a small amount of the medium was seen in the lateral ventricle, indicating communication between the cyst and the ventricular system. It appeared that the lesion was widely disseminated and inoperable. The child died about three weeks later.

Autopsy revealed a hydatid cyst in the left frontal lobe, with secondary cysts throughout the ventricular system.

Three roentgenograms.

GEORGE L. SACKETT, M.D.
Cleveland, Ohio

Vicarious Hyperplasia of Maxillary Sinus in Hypoplastic Processes of the Cerebrum. F. Weickmann. *Fortschr. a. d. Geb. d. Röntgenstrahlen* **88**: 432-439, April 1958. (In German) (Hufeland-Krankenhaus, Berlin-Buch, Germany)

Shape and size of the skull depend a great deal on the extent of cerebral expansion. When the brain fails to develop normally, a microcephaly and pneumatization of the orbital roofs, petrous pyramids, and lesser sphenoidal wings will occur. In unilateral cerebral atrophy, ipsilateral changes and a characteristic asymmetry of the cranial vault are pathognomonic.

The author observed 14 patients with cerebral hypoplasia during a two-year period, 11 of whom had convulsions and vicarious hyperplasia of homolateral sinuses. In 2 additional cases electroencephalographic changes were positive. In all instances the diagnosis was confirmed by pneumoencephalography.

In the three youngest patients, aged two, two and a half, and four years, no deformity could be detected. In 2 cases with bilateral involvement no asymmetry existed. In the 9 remaining cases, with cerebral hemiatrophy, the following characteristic roentgen signs were present: (1) supraorbital recess of sinuses, in 8; (2) homolateral hyperpneumatization of frontal sinuses, pyramids, and lesser sphenoidal wings, in 4; (3) asymmetry of the cranial vault, in 8; (4) obliquity of the crista galli, in 7; (5) obliquity of the sphenoidal plane end of the lesser sphenoidal wings, in 7; (6) homolateral thickening of the cranial vault, in 5; (7) homolateral loss of inner-table relief, in 5; (8) homolateral elevation of the petrous bone, in 4.

Six cases are briefly reported and illustrated by pneumoencephalograms and cerebral arteriograms. It is pointed out that the vicarious hyperplasia of paranasal sinuses differs from the physiologic asymmetry by the simultaneous pneumatization of the orbital roof.

Eleven roentgenograms. ERNEST KRAFT, M.D.
Northport, N. Y.

Mandibulofacial Dysostosis (Treacher Collins Syndrome). Edward J. Pavsek. *Am. J. Roentgenol.* **79**: 598-602, April 1958. (Hospital of the University of Pennsylvania, Philadelphia, Penna.)

An example of mandibulofacial dysostosis in a 52-year-old white female is presented. The patient ex-

hibited the classic manifestations of the syndrome. Roentgenographic examination revealed hypogenesis of the mandible, malar bones, maxillary sinuses, and mastoids. No other skeletal deformities were detected.

The author reviews the literature and lists the following important clinical signs from Franceschetti and Klein (*Acta ophth.* 27: 143, 1949): (1) antimongoloid palpebral fissures with a coloboma of the outer portion of each lower lid and deficiency of the eyelashes (and more rarely in the upper lids); (2) hypoplasia of the facial bones, especially of the malar bones and the mandible; (3) malformation of the external ear, and occasionally of the middle and inner ears; (4) macrostomia, high palate (sometimes cleft), and abnormal position and malocclusion of the teeth; (5) blind fistulas between the angles of the ears and the angles of the mouth; (6) atypical hair growth in the form of a tongue-shaped process of the hair-line extending toward the cheeks; (7) additional anomalies such as facial clefts and skeletal deformities.

The roentgen examination will often reveal the bodies of both malar bones to be grossly and symmetrically underdeveloped. There may be agenesis of the malar bones, with nonfusion of the zygomatic arches, as well as absence of the palatine bones. Cleft palate may be visible on the roentgenogram. There is usually hypogenesis, and sometimes agenesis, of the mandible. The paranasal sinuses are grossly underdeveloped, and the mastoids appear infantile and sclerotic. The auditory ossicles are often absent, and the cochlea and vestibular apparatus may be deficient. The cranial vault is normal in most instances.

The syndrome appears to follow an irregular form of dominant transmission. Developmentally there is retardation or failure of differentiation of maxillary mesoderm at and after the second month of fetal life.

Five roentgenograms. ROBERT S. ORMOND, M.D.
The Henry Ford Hospital

Metastasis in the Nasal Bones. D. O'Connell. *J. Fac. Radiologists* 9: 97-98, April 1958. (Radiotherapy Department, Charing Cross Hospital, London, England.)

This is a report of a 62-year-old woman with breast carcinoma, who two and one-half years following mastectomy noticed a swelling on the bridge of the nose. Six months earlier, minor trauma to the nose had occurred. Roentgen studies revealed almost complete destruction of the nasal bones, osteolytic lesions of the frontal processes of the maxillae, and a soft-tissue mass. Biopsy showed metastatic carcinoma. Irradiation of the lesion (2,000 r at 2 cm. depth) resulted in regression and roentgen evidence of almost complete reconstruction of the involved bony structures.

This is the first report of a metastasis in the nasal bones, according to the author.

Two roentgenograms; 2 photographs.

SAMUEL B. HAVESON, M.D.
University of California, S. F.

The Problem of Mikulicz's Disease. D. J. du Plessis. *South African M. J.* 32: 264-271, March 8, 1958. (Groote Schuur Hospital, Cape Town, Union of South Africa.)

The author discusses at length the nature of Mikulicz's disease of the salivary glands, which he believes is to be sharply distinguished from Sjögren's syndrome. The sialographic appearances are nonspecific and must

be considered along with the clinical and histologic observations. Duct obstruction with failure to fill the ducts and gland beyond the point of occlusion constitutes a striking feature of this condition. The classical sialographic picture is that of sialectasis, which is attributed to extravasation of the injected medium out of the abnormally weak ductules into the interstitial tissue of the gland. It is obvious that the irritation produced by this extravasation of medium will aggravate the fibrosis of this disease, and sialography should thus be done very gently.

Twenty-eight illustrations, including 8 roentgenograms.

Symmetrical Forward Luxation of the Atlas. D. G. Wollin and E. H. Botterell. *Am. J. Roentgenol.* 79: 575-583, April 1958. (Toronto General Hospital, Toronto, Ont., Canada.)

The authors report 11 cases of symmetrical forward luxation of the atlas. Six of the 11 patients had associated congenital abnormalities of the cervical spine. In some, a relatively minor injury accompanied the dislocation; in others no evidence of injury was elicited. There was no history of infection in any of the cases to account for the dislocation.

An experiment was performed in which a dislocation of the atlas was produced in an excised cervical spine by dropping a weight of 8.2 kg. from the neural arch of C-2. The transverse ligament was ruptured and a laminagraph taken before and after, as well as photographs of the specimen, demonstrated the forward displacement of the atlas in relation to the axis.

Normally the anterior arch of the atlas is separated from the odontoid process by only 1 to 2 mm. Flexion and extension roentgenograms of the cervical spine reveal a V-like deformity with an angle of 2 or 3° between the atlanto-odontoid articulation when the chin is depressed.

Anatomists regard the transverse ligament of the atlas as one of the strongest ligaments of the body. Histologically it has no elastic fibers. Traumatic rupture of this ligament may result in immediate death. The cruciate ligament, of which the transverse ligament of the atlas is a part, may be congenitally absent or attenuated, especially in those cases associated with a congenital anomaly. This would facilitate dislocation.

Only one death was recorded in the authors' series, but it is believed that this is a potentially serious type of dislocation. The relatively ample space for the cervical cord at the level of the atlas spared the cervical cord from serious compression in the remaining patients.

Sixteen roentgenograms; 2 photographs; 1 diagram; 1 table.

ROBERT H. LEAMING, M.D.
Memorial Hospital, New York

THE CHEST

Bronchography in Pulmonary Tuberculosis. Studies on Its Value in Patients Being Considered for Surgery. Duane L. Merrill and Paul C. Samson. *Am. Rev. Tuberc.* 77: 561-592, April 1958. (Highland-Alameda County Hospital, Oakland, Calif.)

The authors reviewed 105 cases in which bronchography had been done and made a special study of 43 of these in which pulmonary tuberculosis was present. Dionosil Oil was the contrast material, introduced through an endotracheal catheter into the desired segment or segments. It is believed that this medium has

several advantages over those used previously, notably its rapid disappearance, with no retention leading to pulmonary reaction, and the manner in which the medium tends to coat the walls of the bronchi, making visualization satisfactory well out into the segmental bronchi and bronchioles.

As a result of their study the authors feel that this examination should be used extensively in the preoperative evaluation of patients with pulmonary tuberculosis. Bronchiectasis with terminal bronchostenosis was found to be the early end-result of advanced parenchymal or of endobronchial tuberculosis. Bronchiectasis was also found to be indicative of previous or currently active disease in the involved segment. When terminal segmental stenosis was not present, it was believed that there was some question as to whether or not the involved segments should be removed, providing there was no evidence of tuberculous infiltrate in the segment. The authors are not resecting segments on bronchographic sign of associated bronchiectasis alone. The demonstration of cavities was sporadic and unreliable, but bronchography was found to be useful in evaluation of bronchial disease associated with adenopathy in which stenosis was present, and in bronchial distortion secondary to previous tuberculous disease or to previous resectional surgery. Unsuspected bronchopleural fistulas were also demonstrated.

Forty roentgenograms; 3 tables.

JOHN H. JUHL, M.D.
University of Wisconsin

Bronchopulmonary Moniliasis. Robert Heilig and H. S. Andleigh. *J. Indian M. A.* 30: 82-87, Feb. 1, 1958. (S.M.S. Medical College Hospital, Jaipur, India)

Radiologically bronchopulmonary moniliasis shows little more than a nonspecific peribronchial thickening. Sometimes a peculiar hazy type of linear fibrosis can be seen. In pulmonary moniliasis the shadows vary in size and shape and resemble those seen in bronchopneumonia, except that the edges of the lesions are less sharply defined. Two or more lobes frequently are involved, although the apices usually are spared. The lesions are rather inconstant, and films made at weekly intervals show definite evidences of clearing in some areas and spreading in others. In very severe infections the massive lesions are dense and smooth and often may involve almost an entire lobe. Some lobes may show nearly complete consolidation, while others contain only bronchopneumonic patches.

A case is reported in which, in the course of a protracted febrile disease characterized by a dermatosis of hands and feet, pancytopenia, and liver enlargement, there developed a bronchopulmonary moniliasis with pleural effusion. The bronchopulmonary manifestations and the fever were promptly controlled by Nystatin.

Two roentgenograms; 1 table.

The Coalescent Lesion of Diatomaceous Earth Pneumoconiosis. David M. Caldwell. *Am. Rev. Tuberc.* 77: 644-661, April 1958. (Santa Barbara General Hospital, Santa Barbara, Calif.)

Exposure to diatomaceous earth results in pneumoconiosis which produces a somewhat different roentgenographic picture in the lungs from the typical lesions of nodular silicosis. The roentgen changes fall into two groups: (1) a linear type of pneumoconiosis

with strands of density radiating outward from the hili and (2) coalescent or massive lesions. There is a difference of opinion as to the significance of the coalescent lesions and it is with these that the present study is concerned. The author reports 8 cases followed for ten years. In 4 there was a coexisting active pulmonary tuberculosis and in all of these coalescent lesions were present, with definite cavitation in 3.

Specimens of the lungs were available for pathologic study in all 4 cases and indicated that the coalescent lesions were the result of the infection as well as the dust exposure. Two patients had positive tuberculin tests and in one of these acid-fast bacilli were obtained from the sputum. Both had coalescent disease in addition to the linear type of pneumoconiosis. The other 2 patients had comparable exposure to diatomaceous earth in the diatomite industry but had negative tuberculin tests. They exhibited a linear type of pulmonary fibrosis and a coalescent lesion which was somewhat different from those of the tuberculous patients in that it was bilaterally symmetrical and extended upward and laterally from the hili on both sides. In the patients with tuberculosis, the coalescent lesions were asymmetrical and tended to be more peripheral.

As a result of this study, the author believes that there is a definite difference in the appearance of uncomplicated diatomaceous earth pneumoconiosis and that accompanied by pulmonary tuberculosis; also that, when both diseases are present, each plays a part in the development of the coalescent lesions. Furthermore, in patients with positive tuberculin reactions, it is not possible to state with assurance that infection has not contributed to the production of roentgenographic coalescent lesions when present.

Nine roentgenograms; 4 photographs.

JOHN H. JUHL, M.D.
University of Wisconsin

Congenital Cystic Disease of the Lung with Progressive Pulmonary Fibrosis and Carcinomatosis. Victor A. McKusick and A. Murray Fisher. *Ann. Int. Med.* 48: 774-790, April 1958. (The Johns Hopkins Hospital, Baltimore 5, Md.)

The authors present 3 cases of a variety of congenital cystic disease of the lung in adults, characterized by miliary cysts located particularly in the midportion of the lung, resembling the cystic changes seen in tuberous sclerosis and Marfan's syndrome. The condition appears to be hereditary. Pulmonary lesions may be completely silent and resistant to clinical detection for many years. Clubbing of the fingers and toes or hypertrophic pulmonary osteoarthropathy may develop long before subjective or objective pulmonary signs. The complications of the disease include progressive generalized pulmonary fibrosis, with alveolo-capillary block and/or cor pulmonale. Carcinomatous degeneration may occur as a late complication.

Roentgenographic findings are a generalized reticular pattern in the lung fields consistent with interstitial fibrosis. There may be associated emphysematous changes, and ultimately, in certain cases, hilar carcinoma or diffuse carcinomatosis may be evident. From the illustrations presented in the article, it would appear that the radiographic findings are rather non-specific.

Five roentgenograms; 1 photomicrograph; 3 photographs; 1 table. CAPT. BYRON G. BROGDON, M.C.
Lackland AFB, Texas

Chronic Pneumonitis Simulating Bronchiogenic Carcinoma. Earl B. Sanborn. *Dis. of Chest* **33**: 363-370, April 1958. (Chicago Medical School, Chicago, Ill.)

How long is one justified in following a patient whose roentgenogram reveals evidence of persisting pulmonary infiltrate resembling bronchiogenic carcinoma? The author describes 3 cases which presented him with just this dilemma. After appropriate studies 1 patient had a pneumonectomy (without benefit of frozen section at operation); 1 a bilobectomy, and 1 a segmental resection. All had pneumonitis without tumor.

The policy of "aggression conservatism" is discussed and advocated by the author. This consists in consulting a well-trained thoracic surgeon concerning the advisability of thoracotomy for diagnostic and therapeutic purposes early in the course of a case with a confusing clinical and roentgenographic picture. From then on the handling of the case becomes a matter of care and judgment as exercised by both physicians. Individuality in management is essential.

The decreasing morbidity and mortality from exploratory thoracotomy and pulmonary resection would certainly be factors leading one toward a more aggressive surgical approach.

Four roentgenograms.

RICHARD H. GREENSPAN, M.D.
University of Minnesota

Xanthogranuloma as a Coin Lesion of the Lung.

Jose A. Alegre and John Denst. *Dis. of Chest* **33**: 427-431, April 1958. (National Jewish Hospital, Denver, Colo.)

Isolated noncalcified pulmonary nodules were demonstrable as "coin lesions" in two boys, aged ten and seventeen. In each case the yellow-gray nodule was easily shelled from the lung. Histologically, typical xanthoma cells were present in one and foam cells in large amounts of lipid in the other, the latter recognizable only with the use of stains for fat. The lesions were composed predominantly of spindle-shaped cells resembling fibroblasts, and were very cellular. An inflammatory origin is believed probable, without relation to Hand-Schüller-Christian disease or to eosinophilic granuloma.

One roentgenogram; 3 photomicrographs.

RICHARD H. GREENSPAN, M.D.
University of Minnesota

Traumatic Haemomediastinum: A Case Report.

George Cohen. *South African M. J.* **32**: 298-299, March 15, 1958. (Johannesburg General Hospital, Johannesburg, Union of South Africa)

A case of traumatic hemomediastinum due to a stab wound in the neck is reported, with special reference to the radiological findings. The first chest film (Jan. 8, 1957), though not entirely satisfactory, showed gross widening of the mediastinal shadow and, in addition, an opacity occupying part of the middle third of the left hemithorax. In the lateral view the opacity was seen to be situated in the anterior basal segment of the left lower lobe and in the left lingula. On this basis a diagnosis was made of mediastinal hemorrhage, together with pneumonic consolidation of the affected lingula and lower lobe segments—the latter, it was thought, being in the nature of a "contusion" pneumonia.

Films obtained during the next ten days showed rapid and progressive diminution of the width of the medias-

tinal shadow and almost no change in the region of consolidation in the middle third of the left hemithorax. The opaque left lingula cleared promptly thereafter, the lower lobe somewhat less rapidly.

When the patient was discharged on Feb. 4, except for some slight widening in the region of the aortic knuckle and in the extreme left apex, the condition had returned almost to normal.

Seven roentgenograms.

THE HEART AND BLOOD VESSELS

Mitral Insufficiency—Its Quantitation by Cardiac Ventriculography. Richard A. Gilman, J. Stauffer Lehman, Benjamin G. Musser, and Richard Russell. *J. A. M. A.* **166**: 2124-2126, April 26, 1958. (J. S. L., 230 N. Broad St., Philadelphia 2, Penna.)

The authors discuss quantitation of mitral insufficiency by cardiac ventriculography. Thirty-two patients were so studied for demonstration of the presence and degree or absence of mitral regurgitation. The technic, which involved ventricular puncture, is described in an earlier paper (*Am. J. Roentgenol.* **77**: 207, 1957. *Abst. in Radiology* **69**: 895, 1957).

In 4 patients the atrium was not opacified and at surgery these 4 were proved to have pure mitral stenosis without mitral regurgitation. Any degree of regurgitant opacification of the left atrium during ventriculographic study is considered indicative of mitral valvular insufficiency. On this basis 28 cases of mitral stenosis were diagnosed.

Cardiac ventriculography does not lend itself to exactitude of interpretation but rather only to estimation of the amount of regurgitant opaque substance issuing through the mitral valve and the quantitation of mitral insufficiency. It appears to be a reasonably efficient procedure for evaluating the effectiveness of surgical procedures designed for the correction of mitral insufficiency. Considering operative findings at surgical exploration of the mitral valve as indicative of the presence or absence of mitral regurgitation, there were no false-positive ventriculographic diagnoses of mitral insufficiency. In the same group of patients, there was exact ventriculographic correlation with surgical findings in 21 patients. The discrepancies which occurred in 11 cases were not of sufficient magnitude to invalidate cardiac ventriculography as a reasonable accurate clinical method of quantitating mitral insufficiency.

Eight roentgenograms. THEODORE E. Keats, M.D.
University of Missouri

Angiocardiographic and Physiologic Correlations in Mitral Stenosis. Daniel S. Lukas, Peter R. Mahrer, and Israel Steinberg. *Circulation* **17**: 567-575, April (Part I) 1958. (New York Hospital-Cornell Medical Center, New York, N. Y.)

Fifty-six patients undergoing evaluation for mitral valvuloplasty were examined by catheterization and angiocardiography. The frontal area of the left atrium and the cross-sectional area of the main pulmonary artery as determined angiocardiographically were compared with the hemodynamic data obtained by catheterization. Left atrial size was related inversely to the area of the mitral orifice and the cardiac output and directly to the pulmonary artery pressure. These correlations, though significant, were of low grade.

Complicating fibrillation and mitral insufficiency in-

creased the size of the atrium, but insufficiency without fibrillation did not cause atrial enlargement beyond what would be expected from the underlying stenosis. Giant atria were seen only in cases with fibrillation, usually, but not always, in association with mitral insufficiency. No correlation was found between atrial size and pressure as measured by the technic of wedging a catheter in a small pulmonary artery.

The frontal area of the left atrium was found to correlate well with the heart volume and of course is much easier to measure. It is noted that plain films with the proper amount of penetration will show the outline of the atrium nearly as well as angiocardiology.

The size of the pulmonary artery varied directly with the pressure but did not follow as consistently the variations in the size of the mitral orifice or the pulmonary vascular resistance.

Three roentgenograms; 2 drawings; 2 graphs; 2 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Myxoma of the Left Atrium: Report of Three Cases. Albert Jackson and Pauline E. Garber. *Am. Heart J.* 55: 591-598, April 1958. (Medical and Pathology Services, VA Center, Wadsworth, Kans.)

There is no uniform agreement as to whether myxomas are true tumors or actually represent a thrombus undergoing myxomatous degeneration. The condition is probably not rare. It is difficult to diagnose during life, however, and is more often picked up postmortem.

Three cases proved at autopsy are reported. The first patient was admitted in cardiac failure. During his hospital stay he had sudden syncope and became pulseless. Myxoma was suspected because of his rapid recovery from this episode. The second case was diagnosed as generalized arteriosclerosis. In the third there was a history of recurrent cardiac decompensation. The chest films on all 3 patients showed a normal cardiac configuration except for generalized enlargement of the heart in 1 case.

Myxoma may simulate mitral stenosis. Rapid cardiac decompensation disproportionate to the size of the left atrium is suggestive of the diagnosis. The dyspnea depends on the size of the tumor and the degree to which it obstructs the blood flow. Characteristically the murmur changes with change in the position of the patient.

Angiocardiology is the only method of making a definite diagnosis, demonstrating a filling defect in an enlarged left atrium.

Three photomicrographs; 2 photographs.

ROGER M. STOLL, M.D.
New York, N. Y.

Postpericardiotomy Syndrome Following Surgery for Nonrheumatic Heart Disease. Tomiko Ito, Mary Allen Engle, and Henry P. Goldberg. *Circulation* 17: 549-556, April (Part I) 1958. (New York Hospital-Cornell Medical Center, New York, N. Y.)

The "post-commissurotomy" syndrome following mitral valve surgery (in 10 to 40 per cent of reported cases) has been thought by some to be a reactivation of rheumatic fever. The same condition, however, was noted by the authors following cardiac surgery in non-rheumatic patients and led to the analysis here reported. The syndrome occurred only in patients with wide exploration of pericardium. Of 24 such patients, 13 exhibited the syndrome, but in no case of cardiac surgery

in which the pericardium was not opened was any such complication observed.

The condition itself ("post-commissurotomy syndrome") was then examined in relation to its similarity to pericarditis (idiopathic) and found to be essentially identical. X-ray evidence was conclusive—rapid changes in heart size and shape and frequent occurrence of associated pleural effusions.

The authors conclude that the syndrome results from accumulations of blood in the pericardium and the subsequent reaction to it and that the name should logically be changed to "post-pericardiotomy syndrome."

Nine roentgenograms; 1 table.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Unilateral Pulmonary Artery Absence or Hypoplasia. Radiographic and Cardiopulmonary Studies in Five Patients. John C. Elder, Bernard L. Brofman, Paul M. Kohn, and Bernard L. Charns. *Circulation* 17: 557-566, April (Part I) 1958. (Mount Sinai Hospital, Cleveland, Ohio)

Five additional cases of unilateral absence or hypoplasia of the pulmonary artery are reported, with extensive diagnostic and physiological studies. Plain films show a marked difference in the hilar and peripheral vessel shadows on the two sides and usually the side on which the artery is absent is considerably smaller. Angiocardiology makes the diagnosis apparent. Oxygen uptake studies confirm the absence of function in the lung lacking the pulmonary artery.

Ten roentgenograms; 2 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Anomalous Drainage of the Pulmonary Vein into the Inferior Vena Cava; Case Report and a Review of the Literature. F. Longin and G. Peppmeier. *Fortschr. a. d. Geb. d. Röntgenstrahlen* 88: 386-400, April 1958. (In German) (Medizinische Poliklinik der Universität Würzburg, Germany)

The authors report the case of a woman of forty-eight who had suffered from bronchitis and attacks of pneumonia in childhood. At the age of fourteen an anomalous position of the heart had been noted. There had been dyspnea on exertion at frequent intervals, especially following tonsillectomy at the age of twenty-three, and attacks of severe hemoptysis. The chief complaints were precordial pain, dyspnea on minimal exertion, palpitation, and angina pectoris.

Roentgen examination disclosed displacement of the heart to the right, bulging of the right pulmonary artery, and an atypical vascular shadow in the right middle lung field which widened toward the base. Tomography showed an abnormal dichotomous vascular pattern in the right lung, which became wider caudally and converged toward the right base. A cardiac catheter introduced through a saphenous vein led into the right upper lung field. Blood samples taken through the catheter revealed highly oxygenated blood.

The final diagnoses were: (1) anomalous right pulmonary veins draining arterialized blood into the inferior vena cava; (2) dextroposition of the heart and atrial septal defect with right-to-left shunt; (3) hypoplasia of the right pulmonary artery; (4) hypoplasia of the right lower lobe, large right upper lobe and up-

ward displacement of the right middle lobe, with diminished vital capacity of the right lung.

The literature is reviewed in detail.

Seven roentgenograms; 6 diagrams and charts; 2 tables.

Pulmonary Hypertension. A Symposium. I. The Nature of Pulmonary Hypertension. J. F. Goodwin. Brit. J. Radiol. 31: 174-188, April 1958. (Postgraduate Medical School of London, London, W. 12, England)

II. Radiological Appearances of the Pulmonary Vessels in Pulmonary Hypertension. R. E. Steiner. Ibid., pp. 188-200. (Postgraduate Medical School of London, London, W. 12, England)

III. Interstitial Pulmonary Oedema and Its Radiological Diagnosis: A Sign of Pulmonary Venous and Capillary Hypertension. R. G. Grainger. Ibid., pp. 201-217. (St. Thomas's Hospital, London, S. E. 1, England)

IV. The Pathology of the Pulmonary Vessels in Pulmonary Hypertension. C. V. Harrison. Ibid., pp. 217-226. (Postgraduate Medical School of London, London, W. 12, England)

Pulmonary hypertension is defined by Goodwin as an increase in pressure within the pulmonary vascular bed. The term is, however, an over-simplified one and gives a very limited indication of the state of the pulmonary vascular system. It is important to differentiate between pulmonary arterial hypertension and pulmonary venous hypertension.

Pulmonary hypertension may be due to (1) an increase in flow, as with exercise, arteriovenous fistula, fever, anemia, and left-to-right shunts, such as occur in patent ductus and septal defects, or it may be the result of an increase in resistance (a) in the pre-capillary area as in vasoconstriction associated with anoxia, arteritis, and embolic changes, or (b) in the postcapillary area from obstruction in pulmonary veins, left atrium, left ventricle, mitral valve disease, or constrictive pericarditis.

Pulmonary angiograms are reproduced which demonstrate characteristic changes in the arterial and venous patterns of patients with mitral stenosis having little elevation in pulmonary venous pressure as opposed to those who have an appreciable rise in pressure. Those patients having an increase in left atrial pressure show constrictive changes in the veins and arteries of the lower lung zones. The author believes that this results from long standing increased venous pressure plus hydrostatic pressure. The veins of the lower lung fields constrict when a critical pressure level is reached. This is followed by constriction in the arteries. The venous-arterial constriction explains the characteristic distribution of acute pulmonary edema seen in patients with mitral stenosis, involving the central core of the lungs and the upper portions of the lower lobes. Patients with hypertension and congenital heart disease do not show this venous-arterial constrictive pattern. The author explains this as due to failure of rise in the left atrial pressure.

The multiple causes of pulmonary venous and pulmonary arterial hypertension are discussed at length. Thirteen roentgenograms; 11 charts and diagrams; 2 tables.

According to Steiner, the radiological study of the pulmonary vascular patterns in pulmonary hypertension, combined with a full clinical assessment of the patients, is often all that may be required for a precise

diagnosis of the underlying disease and for estimation of the pulmonary arterial and pulmonary venous pressures. This eliminates the necessity for cardiac catheterization in a large number of patients.

The radiological classification of pulmonary hypertension follows very closely the clinical classification, and the appearances of pulmonary arteries and veins correlate well with the underlying hemodynamic findings. The main radiological patterns are:

I. With marked pulmonary plethora there are dilated pulmonary arteries. This is due to an increased flow in patients with congenital heart disease, such as atrial septal defect and patent ductus arteriosus.

II. (a) When there is increased resistance to pulmonary flow with an increase in postcapillary resistance, one sees the radiographic appearance of pulmonary venous hypertension with engorgement of pulmonary veins, some distention of pulmonary arteries, and background pattern in the lungs of varying degrees of interstitial pulmonary edema.

II. (b) When there is increased resistance to pulmonary circulation due to increased pre-capillary resistance, there is radiographic demonstration of pulmonary arterial hypertension, associated with marked distention of the pulmonary arteries and relative narrowing and underfilling of the smaller peripheral pulmonary arteries. The vascular patterns of pulmonary venous and arterial hypertension can be found together in patients with mitral heart disease. The patterns of increased flow and pulmonary arterial hypertension can be present together in patients with congenital heart disease, such as atrial septal defect, ventricular defect, and persistent patent ductus arteriosus.

Twenty-four roentgenograms; 1 photograph; 1 diagram; 3 tables.

Alveolar pulmonary edema (edema fluid either in alveolar air spaces or in the connective-tissue framework which supports and permeates the lung) is diagnosed clinically without difficulty. Interstitial pulmonary edema, on the other hand, in which the fluid lies only in the interstitial connective tissue of the lung does not lend itself to clinical diagnosis. It can be confidently diagnosed by simple radiologic study.

The diagnosis of interstitial pulmonary edema is based upon demonstration of fine dense thread-like lines in the lung base or center of the lung (A and B lines). Grainger believes there is abundant evidence relating these radiographic lines to an increased radiopacity of connective-tissue stroma or septa of the lungs. This radiopacity most frequently results from an interstitial, extra-alveolar pulmonary edema, in which the edema fluid is localized to the connective-tissue framework of the lung. The presence of these A or B lines may therefore be used as a radiologic sign of interstitial pulmonary edema. This edema is most commonly related to high pulmonary venous pressure of failure of the left side of the heart.

This interpretation is based upon considerable work which the author believes is sufficient proof of the following points. This proof is presented in detail.

1. That B or A lines are due to the radiopacity of the interlobar septa.

2. That the increased radiopacity of the septa is frequently due to edema fluid.
3. That identical radiographic septal lines may be found in interstitial pulmonary edema of any etiology.
4. That B lines in cardiac disease are always associated with a high pulmonary venous and capillary pressure.

Seventeen roentgenograms; 9 photomicrographs; 1 photograph; 3 charts; 1 table.

The final paper in the symposium is concerned with the postmortem findings in the groups of cases of pulmonary hypertension discussed in the previous papers.

Harrison describes close agreement between *in vivo* and postmortem angiographs in mitral stenosis. The arterial narrowing has been shown to be due to musculo-elastic hypertrophy and increased tonus in the majority of cases and to irreversible atheromatous narrowing in the minority.

With regard to the distribution of pulmonary edema, the postmortem findings bear out the radiographic changes seen during life. In patients who die with acute pulmonary edema, both the edema and congestion are seen to be maximal in the posterior part of the upper lobe and the apical segment of the lower lobe. This distribution is the reverse of the arterial hypertrophy and narrowing. The author concludes from this that "the pulmonary hypertension is produced by a raised tonus in the pulmonary arteries, probably in the small muscular branches just proximal to the true arterioles. This tonus is greater and is associated with greater muscular hypertrophy in the lower zones. The stimulus that excites this increased tonus apparently arises beyond the pulmonary capillaries and is mediated through some sort of reflex. In view of the differential tonus in the upper and lower zones, it is perhaps reasonable to suggest that the stimulus may arise in the pulmonary veins, which show a similar differential hypertrophy."

Clinico-pathologic correlation is also discussed with regard to: (1) pulmonary hypertension due to left ventricular failure; (2) pulmonary hypertension due to congenital heart disease; (3) pulmonary hypertension due to increased precapillary resistance; (4) primary or idiopathic pulmonary hypertension; (5) obstructive pulmonary hypertension.

Seven roentgenograms; 16 photomicrographs.

RICHARD A. ELMER, M.D.
Atlanta, Ga.

Introductory Remarks Concerning the Urologic Aspects of Hypertension. R. M. Nesbit. *Circulation* 17: 693-695, April (Part II), 1958. (University of Michigan Medical School, Ann Arbor, Mich.)

A brief review is given of the role of unilateral nephrectomy in the treatment of hypertension. Since 1937, in the University of Michigan Hospital, pyelograms have been obtained routinely in cases of hypertension. In 4.5 to 5 per cent, abnormalities of the kidneys have been found which might conceivably be responsible for the high blood pressure. In the presence of a unilateral lesion, such as chronic pyelonephritis, the results of nephrectomy have been satisfactory in about 50 per cent of the patients but the cure rate has been only 20 per cent. At present there is no known way to predict which cases will benefit. Pyelograms may be entirely negative in rare instances of hypertension due to vascular lesions in the kidney. Such cases are diagnosable only by arteriography.

A case is reported in an 11-year-old girl, hypertensive for four to five years, with bilateral pyelonephritis. Splanchnicectomy was done bilaterally, with temporary relief of the hypertension. At a subsequent admission for an acute flare-up of the pyelonephritis, it was discovered that the patient urinated only once daily. She was instructed to empty her bladder every four hours and the infection was treated with antibiotics. On this regime her blood pressure fell to nearly normal levels and remained there for the two years which had elapsed to the time of this report. Ureteral reflux was originally demonstrated on delayed cystography but was no longer present one year after the patient started voiding every four hours.

Three roentgenograms. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

The Early Diagnosis of Ruptured Abdominal Aneurysm. Richard T. Beebe, Samuel R. Powers, Jr., and Edward Ginouves. *Ann. Int. Med.* 48: 834-838, April 1958. (Albany Hospital, Albany, N. Y.)

During a five-year period, 18 patients with ruptured abdominal aneurysms were seen and in 7 of these the diagnosis was made in time to permit surgical exploration. One patient died during operation. There was temporary benefit in 2 cases, and in 4 cases resection and grafting were successfully performed.

Each case presented as an acute abdominal catastrophe with variable symptoms. The authors stress the value of three findings in early diagnosis; (1) ecchymosis in the lower abdomen or perineum; (2) loss of deep tendon reflexes in the lower extremities; (3) loss of the psoas shadows in abdominal roentgenograms. All three of these findings are attributed to retroperitoneal hemorrhage and permit diagnosis before rupture into the free peritoneal cavity with resultant massive blood loss and peritonitis. The roentgenographic finding is particularly stressed and was the sole criterion permitting the correct preoperative diagnosis in 3 of the 7 cases.

Three illustrative case reports are presented.

One roentgenogram. CAPT. NEIL E. CROW, M.C.
Lackland AFB, Texas

Unilateral Rib-Notching from the Collateral Circulation After Division of the Subclavian Artery. Maurice Campbell. *Brit. Heart J.* 20: 253-260, April 1958. (Cardiac Department, Guy's Hospital, London, England)

Three examples of unilateral rib-notching after subclavian-pulmonary anastomosis are reported. Two of the anastomoses were performed for Fallot's tetralogy and one for tricuspid atresia. The notching was always on the side where the subclavian artery had been divided. The author states that notching under these conditions is not common and is seen most frequently by radiologists, but does not seem to be so widely known among physicians as a group.

Unilateral rib-notching is due to collateral circulation to the arm of which the subclavian has been divided. When the first part of the subclavian is divided, the branches are not fully available for collateral circulation. Under these conditions, an important source of the blood supply is from the aortic intercostal arteries to the anterior intercostals and thus to the trunk of the internal mammary artery, and by its anastomoses in the chest wall to the superior thoracic and lateral thoracic branches to the axillary artery.

Other cases of unilateral rib-notching are discussed briefly to emphasize the incidence of this condition following subclavian artery ligation.

Eight roentgenograms.

CAPT. NEIL E. CROW, M.C.
Lackland AFB, Texas

Significance of the Venous Phase in Arteriographic Studies of Bone and Soft Tissue Tumors. Robert Schobinger, Ru Kan Lin, and Herschel C. Moss. *Cancer* 11: 315-321, March-April 1958. (Roswell Park Memorial Institute, Buffalo, N. Y.)

Detailed angiographic studies were obtained with a standard technic on a group of 70 patients with benign and malignant bone and soft-tissue tumors. For the first 60 examinations 50 per cent Urokon was employed; the remainder were done with 50 per cent Hypaque, which was thought to be better tolerated. Special attention was given to the venous phase, which has heretofore received relatively little consideration.

In all the benign lesions studied the arterial phase was normal. While most of the benign lesions also demonstrated a normal venous phase, there existed a small group, histologically distinct, that showed retention of contrast medium during the venous phase. This included benign giant-cell tumor, osteitis fibrosa cystica, aneurysmal bone cyst, and nonosteogenic fibroma. The degree of radiopacity in the venous phase appeared to parallel the presence of giant cells rather than the relative histological vascularity of the lesion.

Most but not all malignant neoplasms exhibited an arterial pattern characterized by the presence of tumor vessels. The absence of abnormal vessels during the arterial phase did not preclude pathological findings during the venous phase. In the great majority of malignant tumors there was retention of contrast medium during the venous phase which was of only brief duration or moderately pronounced. Only reticulum-cell sarcoma of bone and Ewing's sarcoma appeared to retain contrast material over long periods of time and in a peculiarly intense manner. [An addendum to the article modifies this last statement, to the effect that further experience with osteogenic sarcoma, lymphosarcoma, and osteolytic metastases has shown some of them to retain the contrast medium much longer than indicated above.]

Observations set forth by the authors tend to support the hypothesis that giant cells originate from the reticuloendothelial system, considering as a criterion the roentgenographic retention of contrast medium. These observations also support the opinion that Ewing's sarcoma originates from reticuloendothelial elements, as does reticulum-cell sarcoma, these two tumors being generally accepted as distinct entities.

Twenty-one roentgenograms.

CHARLES M. GREENWALD, M.D.
Iowa City, Iowa

An Evaluation of the Hazards of Aortography. Eric Samuel and Michael Denny. *Arch. Surg.* 76: 542-545, April 1958. (1 Lister Bldg., 195 Jeppe St., Johannesburg, Union of South Africa)

Despite the title of this paper, it is concerned primarily with making the point that aortic dissection was the most likely causative factor in a case of fatal renal failure previously reported by Conger *et al.* (Conger, Reardon, and Arey: *Arch. Surg.* 74: 287, 1957. *Abst. in Radiology* 69: 909, 1957). The present authors pro-

ceed to prove by reanalysis of the data and roentgenograms that the cause of death was actually aortic wall dissection by the contrast material, with occlusion of the renal arteries and probably the superior mesenteric artery. They do not feel that the chemotoxic theory of renal failure has been adequately proved. A similar, nonfatal case is mentioned and illustrated by four roentgenograms.

A plea is made for more extensive use of the Seldinger method of aortography, in which the catheter is ultimately introduced into the femoral artery over a flexible guide wire which has previously been passed, through a percutaneously inserted cannula (*Acta radiol.* 39: 368, 1953. *Abst. in Radiology* 62: 466, 1954). With this method the exact level for opacification can be accurately chosen and the main danger of translumbar aortography (aortic dissection) is obviated. The femoral cutaneous catheterization technic will not suffice for the Leriche syndrome, but is generally satisfactory for studies of other vascular diseases. It is also helpful in the study of renal diseases. "It would appear that debate on the value of translumbar aortography in respect to renal disease is outmoded and redundant. The method is plainly and simply contraindicated. This is particularly so in the investigation of the renal blood supply in hypertensive disease." The femoral-aortic catheterization method of Seldinger should be used in such studies.

Five roentgenograms. JAMES W. BARBER, M.D.
Cheyenne, Wyo.

Pitfalls of Translumbar Aortography and Peripheral Arteriography. John R. Derrick, William D. Logan, and John M. Howard. *Arch. Surg.* 76: 517-520, April 1958. (Emory University School of Medicine, Atlanta, Ga.)

A brief summary of the pharmacology of contrast media for arteriography and the technics of injection is given. Previously reported intestinal, renal, vascular, and local complications are noted, with brief comment. A standardized procedure utilized in the 50 aortographic or arteriographic studies most recently performed in the Grady Memorial Hospital (Atlanta) is described. In 48 instances helpful or critical information was gained, and no important side-effects were encountered. It is suggested that with suspected peripheral arterial insufficiency a relatively dilute contrast solution (35 per cent) is probably preferable.

For demonstration of the aorta a pressure cuff inflated around each thigh prior to injection by translumbar methods will frequently aid in attaining a better concentration of contrast material in the proximal vessels, but this maneuver was seldom found necessary. For arteriograms of the lower extremities, an initial injection of a few cubic centimeters of dilute contrast medium after placement of the needle or catheter will allow one to ascertain the time of the "flush reaction" in the leg, and hence to time the later definitive exposure more accurately.

The authors feel that contrast material concentration for femoral arteriograms should be in the 35 per cent range. The rare complication of paraplegia associated with aortography is thought to result from high concentration of contrast material entering the anterior spinal artery. Pilot films after a small amount of medium has been injected may allow one to avoid this complication.

JAMES W. BARBER, M.D.
Cheyenne, Wyo.

Sudden Death Due to Translumbar Aortography. Bohdan J. Koszewski, William J. Reedy, and Frank Iwerson. *Ann. Int. Med.* 48: 902-907, April 1958. (W. J. R., 324 City National Bank Bldg., Omaha 2, Nebr.)

The authors report a case of fatal anaphylactic reaction following translumbar aortography with 70 per cent Urokon. The patient was a 68-year-old diabetic male who complained of intermittent claudication in the right hip and impotence. He had experienced a myocardial infarction seven years previously. Physical findings were consistent with a poor vascular supply to both lower extremities, more marked on the right.

Intraocular and intravenous test doses of Urokon provoked no untoward reactions. Aortography was performed under local anesthesia following Nembutal, Demerol, and atropine premedication. With the patient in the routine prone position, injection was made at a level just below the left 12th rib. Roentgenograms demonstrated complete obstruction of the right common iliac artery and an appositional thrombus along the wall of the lower aorta.

There was no pain during injection. One minute later, the patient complained of a burning sensation throughout his body, and two minutes later he became markedly dyspneic and apprehensive. His face was cyanotic, and urticarial lesions appeared on the forearms and shoulders. Despite immediate injection of epinephrine, death occurred in pulmonary edema; heart resuscitation measures were not successful. This was considered to be an anaphylactic reaction and subsequent autopsy showed no other cause of sudden death.

The literature is reviewed with respect to reactions following aortography. The authors recommend routine use of oral cortisone as prophylactic premedication.

CAPT. BYRON G. BROGDON, M.C.
Lackland AFB, Texas

Osteomedullary Phlebography. Z. Zsebök and R. Gergely. *German M. Monthly* 3: 116; 119-122, April 1958. (Radiological Unit of First Surgical Department, University of Budapest, Hungary)

Radiologic study of the deep veins of the leg is essential for the proper planning of treatment of superficial varicosities, for the patient's disability is often due to dilatation of the deep veins. It is also important in demonstrating the vascular lesions in certain cases of elephantiasis, induration, and edematous swelling.

The deep veins in subjects with normal circulation are easily demonstrated by injection of an opaque medium in a superficial vein, with or without application of bandages to the leg. In abnormal cases, however, where thrombosis has occurred, it is difficult or impossible to fill the deep venous circulation by this method. The authors have found that injection of opaque medium into the medulla of bone demonstrates the deep and the superficial veins to best advantage.

The technic of osteomedullary phlebography is as follows: After topical anesthesia with 1 per cent novocain, 20 c.c. of contrast material (Triopac 400) is injected within thirty seconds into the head of the fibula for visualizing the veins of the thigh, or into the calcaneus for the veins of the calf. A sternal puncture needle is used and through it novocain (0.1 c.c./10 c.c.), and the medium are injected together. The patient is placed in the upright position first, then prone. The flow of the opaque medium is observed by fluoroscopy and serial roentgenograms are taken accord-

ingly. Anteroposterior and lateral views are indicated. Veins normally empty within two minutes in the prone position and within five minutes with the patient upright. The author does not mention the number of cases examined but states that he has encountered no complications.

Eleven roentgenograms.

J. S. ARAJ, M.D.
Toledo, Ohio

THE BREAST

Analysis of 2,514 Examinations During Early Phases of an X-Ray Survey of the Breast. J. Gershon-Cohen, Helen Ingleby, and Lolita Moore. *Surg. Gynec. & Obst.* 106: 478-480, April 1958. (Albert Einstein Medical Center, Northern Division, Philadelphia, Penna.)

The authors feel that, although most breast carcinomas are found by the patient, by the time the nodule has reached a diameter of 1.0 cm. it has undergone possibly thirty of the forty life-cycle doublings of which it is capable. They present a series of 2,514 examinations of 1,291 asymptomatic women. Of these patients, 44 eventually underwent surgery, 25 because a question of carcinoma had been raised. Five patients were found to have carcinoma, all but one of which were less than 1.0 cm. in diameter, and in 3 of these there was axillary node involvement. Of the 5 proved carcinomas, 2 were definitely diagnosed by the radiologist, although in all 5 physical examination in the preceding three months had been negative. Seven patients were found to be negative for tumors, but subsequent x-ray examinations again demonstrated soft-tissue masses. The remainder of the benign lesions were distributed between precancerous lesions, fibroadenomas, inflamed cysts, sclerosing adenomas, and intraductal hyperplasias. It is the authors' opinion that this examination has much to offer in the early detection of carcinoma of the breast.

Two tables.

MARK M. MISHKIN, M.D.
University of Pennsylvania

THE DIGESTIVE SYSTEM

Roentgenologic Demonstration of Recurrent Tracheo-esophageal Fistula Following Surgical Repair of Congenital Oesophageal Atresia. C. E. Gudbjerg and Tyge Cl. Cørtz. *Acta radiol.* 49: 276-280, April 1958. (Rigshospitalet, Copenhagen, Denmark)

In the authors' series of 52 surgically treated cases of esophageal atresia (no H-type tracheo-esophageal fistula included), a recurrent tracheo-esophageal fistula developed in 10, about three months after operation. Three cases were unsuspected and were recognized only on postmortem examination. Seven of the 10 patients were examined roentgenographically. In 5 of these a soft rubber catheter was introduced under fluoroscopic control and aqueous Dionosil was injected. In 4 out of this group the fistula was demonstrated prior to operation.

In the typical case, the diagnosis of recurrent fistula can be made clinically with certainty, once esophageal stricture has been ruled out. The authors believe, however, that radiographic demonstration of the fistula is a valuable adjunct to surgery.

Two roentgenograms. JOSEPH E. WHITLEY, M.D.
Bowman Gray School of Medicine

Cardiomyotomy for Achalasia of the Cardia: The Experience of the Middlesex and Harefield Hospitals up to 1955. E. D. Acheson and G. D. Hadley. *Brit. M. J.* 1: 549-553, March 8, 1958. (Institute of Clinical Research, Middlesex Hospital, London, England)

The authors review their experience with cardiomyotomy for achalasia of the cardia from April 1947 through August 1955, in which period 35 patients underwent the operation; 27 of these had complete follow-up, and 6 incomplete follow-up. There was no operative mortality. Two patients died of coronary thrombosis seven and thirteen months following operation. In 7 cases the procedure was considered a failure since further mechanical treatment was required for dysphagia. Only 1 patient was classified as cured according to such rigid standards of assessment as improvement in radiographic findings, increase in body weight, and absence of symptoms, but 20 of 27 interviewed were classed as improved. More than half of the patients who improved radiologically had had symptoms of achalasia less than five years. Peptic esophagitis was a common finding after operation, but usually it was mild.

In the opinion of the writers, while improvement after operation may be only relative, it almost always affords relief from regurgitation of food during meals and ameliorates many of the other discomforts to a degree that gives the patient a feeling of subjective improvement.

One roentgenogram; 2 charts; 3 tables.

DAVID L. ROBINSON, M.D.
Bowman Gray School of Medicine

Asymptomatic Gastric Retention in Diabetics (Gastroparesis Diabeticorum). Paul Kassander. *Ann. Int. Med.* 48: 797-812, April 1958. (VA Hospital, Manchester, N. H.)

Of 27 routinely admitted diabetics, 6 were found to have asymptomatic gastric retention. Roentgen examination showed the stomachs of these 6 patients to have a patulous pylorus, while peristalsis was of extremely poor quality or absent. Retained material could be manually expressed from the stomach, and some slight success was obtained in stimulating gastric emptying by means of medication such as Urecholine or Mecholyl.

Gastric retention in these cases is held to represent a disturbance of propulsion, which the author feels is attributable to diabetic neuropathy. However, in each case the patient was being treated with long-acting insulin which contain zinc, and the possibility that zinc plays a role in the neuropathy is entertained.

The onset of gastric retention in diabetics is insidious, masked, and without any definite symptoms. It occurs in anorexic, diarrheal diabetics with manifest neuropathy, as well as in those who have no symptoms other than uncontrolled diabetes.

Forty-six roentgenograms; 1 table.

CAPT. BYRON G. BROGDON, M.C.
Lackland AFB, Texas

Functional Disturbances of the Duodenum. H. Kamieth. *Fortschr. a. d. Geb. d. Röntgenstrahlen* 88: 406-414, April 1958. (In German) Strahleninstitut der Universitätskliniken, Landeskrankenhaus Homburg/Saar, Germany)

Hypertonicity as well as atony of segments of the intestinal tract can be purely functional, secondary to

disease of nearby organs. In such instances one speaks of a viscerovisceral reflex, a condition most frequently found in the duodenum.

The author observed 50 patients with disturbed motility and tonicity of the duodenum (4 per cent of all gastrointestinal studies): 31 males and 19 females mostly between the ages of twenty-five and sixty. Thirty-four cases showed spasticity, which tended to be temporary, and 16 were of the hypotonic type, a more permanent condition. In 2 cases spastic and hypotonic changes could be observed simultaneously. A definite impression could be gained only after administration of a large amount of barium. In addition to disturbed tonicity, there were changes of mucosal pattern and hypomotility.

In only 4 cases could a duodenal ulcer be found. The biliary tract was the seat of underlying disease in 39 cases, organic in 24 and functional in 15. Pancreatitis was present in 5 cases and gastritis in 1. In the remaining patient there was a central nervous system disturbance. The papilla of Vater could be visualized in 4 of the hypotonic but in none of the spastic cases.

The author believes that the functional changes can be explained by viscerovisceral reflexes in some cases. In others, with only functional disturbances in nearby organs, a vertebro-visceral reflex must be assumed.

Eleven roentgenograms. ERNEST KRAFT, M.D.
Northport, N. Y.

The Coil-Spring Sign and Intramural Hematoma of the Proximal Small Intestine. Kenneth F. Swaiman, Jill F. Root, and Richard B. Raile. *J. Dis. Child.* 95: 413-416, April 1958. (University of Minnesota Medical School, Minneapolis 14, Minn.)

A case of intramural hematoma of the duodenum induced by trauma is presented. The patient, a ten-year-old boy, had sustained a severe blow to the upper abdomen three days prior to admission to the hospital. The following day he began to vomit and experienced steady right upper quadrant pain. The vomiting and pain increased in the following two days. On admission to the hospital he was found to be markedly dehydrated, and a firm, tender 8 × 8-cm. mass was palpated in the right upper quadrant. An upper gastrointestinal series revealed an area of luminal widening in the third portion of the duodenum associated with a smooth-walled intramural mass. The valvulae conniventes were seemingly forced together, producing a striking coil-spring effect outlined with barium. There was no associated shortening of the duodenum. At laparotomy, an 8 × 12-cm. hematoma of the wall of the third portion of the duodenum was found.

The coiled-spring configuration is occasionally seen in intussusception of the small bowel but it is accompanied by shortening of the bowel and an inner lumen of small caliber.

Twenty cases of intramural hematoma have been reported and about 60 per cent have occurred in children. Trauma is the leading cause of this entity, and 7 of the 8 cases in which the "spring sign" was present were due to that cause. The authors feel that the fixation of the distal duodenum by the ligament of Treitz predisposes this area to injury, because it can be forced against the spine, with probable compression of the adjacent mesenteric attachments.

Two roentgenograms; 1 photograph.

H. GOULD, M.D.
St. Vincent's Hospital, N. Y.

Varying Radiological Appearances in the Terminal Ileum Associated with Crohn's Disease. M. G. Desai. J. Fac. Radiologists 9: 99-105, April 1958. (Department of Radiology, Manchester Royal Infirmary, Manchester, England)

The author reviews the literature on regional enteritis (Crohn's disease), summarizing the pathologic findings. The radiologic appearances in 13 patients ranging from sixteen to forty years are reported and classified. Ten of the cases were primary and 3 recurrent. The radiological findings in the terminal ileum were tabulated as follows:

(1) *Narrowing of the terminal ileum*, encountered in 7 cases, 5 of which showed marked stenosis and the "string sign."

(2) *Dilatation of the terminal ileum*. Two cases exemplifying this finding are described. In each instance there was involvement of the ileocecal junction and proximal colon, but histologic study showed active Crohn's disease in the dilated segment of the terminal ileum.

(3) *Ulcer crater in the terminal ileum*. This is a common pathologic finding but is rarely demonstrated radiologically. One such case is illustrated.

(4) *Small rounded translucent areas in the terminal ileum*, due to polypoid changes in the mucosa.

(5) *A "skip" segment in the terminal ileum*. This picture is produced when segments of the terminal ileum present varying degrees of advanced stenosis with more normal appearing bowel in the lesser involved segments between.

(6) *Normal appearance of the terminal ileum*, although involved by disease. One such case is reported, in which the only abnormal finding was a constantly narrowed cecum. At operation the involvement of the cecum was confirmed and on histological examination both the terminal ileum and the cecum showed Crohn's disease. The author notes that deformity of the cecum may be the only radiological sign in Crohn's disease. This may be due to spasm, fibrosis and adhesions, or extrinsic pressure.

In cases of recurrence of regional enteritis, the roentgen findings may be narrowing of the ileum proximal to the anastomosis or loss of the mucosal pattern and poorly defined outline of the ileum proximal to the anastomosis.

Twelve roentgenograms; 1 diagram; 2 tables.

GEORGE L. SACKETT, M.D.
Cleveland, Ohio

A Unique Case with Roentgenologic Evidence of Regional Enteritis of Long Duration and Histologic Evidence of Diffuse Adenocarcinoma. Solomon R. Bersack, John S. Howe, and Edward M. Rehak. Gastroenterology 34: 703-710, April 1958. (Mt. Alto Veterans Hospital, Washington, D. C.)

The authors were originally reluctant to report the following case since no instance of carcinomatous change in regional enteritis could be found in the literature. In 1956, however, there appeared a report of a single example (a cancer of the jejunum) by Ginzburg *et al.* (Surgery 39: 347, 1956) and publication of the earlier case was felt to be indicated.

The patient was a white male first seen in 1947 for a condition which had been recurring since 1943. Clinical and radiological findings gave rise to the diagnosis of regional enteritis. First with the utilization of non-specific drugs, and later with cortisone, periods of ex-

acerbation were controlled clinically and the roentgen picture improved.

In 1953 abdominal masses were detected and by 1954 the lower half of the abdomen was filled with a mass. Fluctuant abscesses also developed in the lower abdominal wall. The patient died in April 1954. Autopsy showed widespread involvement of the intestinal tract by an adenocarcinomatous process. Metastases were present in the lungs, adrenals, mesenteric lymph nodes and peritoneum. The only histologic evidence of a regional enteritis was pyloric type glands in the ileum.

The duration of at least nine and possibly eleven years makes this case unique even if it were interpreted as an adenocarcinoma from the start. Reasons are adduced militating against such an assumption. It is postulated that adenocarcinoma supervened on the basis of a burned out regional enteritis of long standing.

Nine roentgenograms; 4 photomicrographs.

JOSEPH P. TOMSULA, M.D.
Baton Rouge, La.

Volvulus of the Midbowel and Its Resulting Intestinal Obstruction. Nathan J. Saltz and Edmund Luttwak. Arch. Surg. 76: 633-638, April 1958. (Hadassah Medical Organization, P. O. B. 499, Jerusalem, Israel)

The most common type of rotational anomaly in the embryologic development of the intestine occurs when the rotation process is arrested prior to completion and the cecum fails to descend from the subhepatic area. Frequently the cecum is bound down in a subhepatic position by peritoneal bands crossing and compressing the duodenum in its third portion. Should volvulus occur, not only is the blood supply to the midbowel compromised as a result of torsion and compression of the superior mesenteric artery, but traction on the peritoneal bands produces pressure on the duodenum, and a high intestinal obstruction results.

Symptoms of volvulus ordinarily appear very early in life, usually before three weeks of age, and are those of partial or complete duodenal obstruction. Vomiting is constant and frequently projectile, and the vomitus is bile-stained. Meconium or normal stools are usually passed early in the course of the disease, with blood in the stool only after vascular compromise and necrosis.

Diagnosis can frequently be made on the basis of plain films of the abdomen. Characteristic findings include dilatation of the stomach and duodenum, with a fluid level in each, and absence of gas in the remainder of the gastrointestinal tract. Occasionally these findings will be better shown on films obtained with the infant inverted or in decubitus position. Infrequently severe vomiting will have removed all contents from the obstructed stomach and duodenum so that an airless abdomen presents. In such cases insertion of an esophagogastric catheter and injection of small quantities of air will result in typical findings. In cases of doubt, additional support for the diagnosis may be obtained by a barium enema study, showing the colon in the left abdomen. Ordinarily barium by mouth is unnecessary and may be dangerous because of frequent vomiting and possible aspiration.

Treatment of the condition is early surgery. The two developmental abnormal components must be corrected: reduction of volvulus in the midbowel and section of peritoneal bands to relieve pressure on the duodenum, followed by placement of the cecum in normal position. If treatment is delayed until vascular compromise and bowel gangrene develop, prognosis becomes poor.

Five illustrative cases are recorded. All presented quite typical findings.

Eight roentgenograms; 1 diagram.

JAMES W. BARBER, M.D.
Cheyenne, Wyo.

Problems in Diagnosis and Principles of Treatment of Cancer of the Large Bowel. Leland S. McKittrick. Wisconsin M. J. 56: 486-491, December 1957. (Harvard Medical School, Boston, Mass.)

In a study of 100 consecutive patients operated upon for cancer of the large bowel, it was found that 31 came too late to be given a reasonable chance of cure. This delay was due to failure of the physician to recognize the importance of the symptoms. One of the chief factors involved in this failure was a feeling of false security due to overconfidence in the accuracy of an x-ray examination. Only rarely, however, is the radiologist given the information necessary for satisfactory studies and interpretation of findings.

No patient should be sent to the radiologist for roentgenography of the large bowel under suspicion of cancer unless very careful abdominal, rectal, bimanual, and sigmoidoscopic examinations have been carried out. The clinician should acquaint the radiologist with the information he has obtained and with his suspicions; and he should recognize the inability of the radiologist, regardless of experience, always to evaluate accurately a given bowel. There are always two sources of error in roentgen studies: it may be impossible to visualize the lesion, and the abnormality may be demonstrated but incorrectly interpreted.

The diagnostic problems are discussed in detail and the principles of surgical management are outlined.

Two tables.

Blind-Pouch Formation Following Lateral Anastomosis. Leo H. Pollock. Arch. Surg. 76: 536-541, April 1958. (Rockhill Road at 63rd St., Kansas City, Mo.)

Following intestinal resection with side-to-side anastomosis there may subsequently develop a large blind pouch in the closed end of the proximal segment. Such pouch development is not necessarily related to leaving a long blind end in the proximal segment at the time of surgery. The blind pouch may appear several months to several years after the initial operation and is seen most frequently with side-to-side ileocolic operations. Symptoms vary widely but are usually those of subacute or low-grade intestinal obstruction. Diagnostic features may include a palpable abdominal mass with tenderness.

Roentgen examination is the most important means of diagnosis. A large gas bubble may be seen on the plain film. The pouch may be recognized by retained barium or the presence of elongated and hypertrophied mucosal folds in a localized area.

Treatment is surgical resection.

Two cases are reported. The first patient was a 63-year-old man in whom a blind pouch was discovered on a routine barium enema examination eight years after ileocolostomy for carcinoma of the rectum. Five years later a sudden fainting episode with vomiting and intestinal hemorrhage led to a second operation, at which the pouch was excised. The second patient was a 50-year-old white woman who apparently underwent partial ileal resection and anastomosis for pelvic inflammatory disease. Approximately ten years after her

initial surgery, symptoms of partial small bowel obstruction developed. A plain film of the abdomen showed an irregular gas shadow just to the left of the cecum and a barium enema study revealed a short widened segment of ileum among the intestinal coils corresponding to the gas bubble on the scout film. Operation revealed blind pouch formation in the ileum at the site of a side-to-side ileo-ileostomy.

Histologic studies on the excised specimens in these cases showed mucosal and submucosal ulcerations within the pouch and extensive low-grade inflammatory changes surrounding it.

Three roentgenograms; 2 diagrams demonstrating the relationship of the pouches to the anastomoses.

JAMES W. BARBER, M.D.
Cheyenne, Wyo.

The Radiological Diagnosis of Enlargement in the Region of the Pancreas with Special Reference to Increase in the Retrogastric Space. E. H. Schultz, Jr. Cancer 11: 310-314, March-April 1958. (Department of Radiology, Mount Auburn Hospital, Cambridge, Mass.)

Utilizing retrogastric measurements and barium studies of the upper gastrointestinal tract, the author made a diagnosis of abnormal mass or enlargement in the region of the pancreas in 50 patients. The size of the retrogastric space was determined routinely by either a cross-table supine view (Poppel *et al.*: Am. J. Roentgenol. 61: 56, 1949) or the positions of Sheinmel and Mednick (Am. J. Roentgenol. 65: 77, 1951. Abst. in Radiology 57: 916, 1951), or both.

Lesions included carcinoma of the pancreas, pancreatitis, enlarged nodes, and other retroperitoneal masses. Increase in the retrogastric space was found to be the most consistent radiologic abnormality, being present in 44 of the 50 patients. Other radiologic changes described as indicative of pancreatic tumor were often helpful in diagnosis but were found less frequently than forward displacement of the stomach. Roentgenographic changes were nonspecific for preoperative identification of the type of disease except that the "inverted 3" sign occurred only with intrinsic disease of the pancreas.

There were 18 cases of carcinoma of the pancreas. Increase in the retrogastric space was seen in 17 of the 18, other evidences being flattened medial duodenal folds in 8, deformity or obstruction of the duodenum in 7, a pad effect in 5, elevation of the gastric antrum in 5, mucosal destruction in 4, inverted 3-sign in 2, and dilated common duct and widened duodenal loop in 1 each.

Of particular interest was the demonstration of pancreatic enlargement in 7 patients with chronic pancreatitis. There had been a recent exacerbation of symptoms in 4 of 5 patients with chronic pancreatitis who had an increase in the retrogastric space. Enlargement can thus be explained by relapse. In the absence of clinical evidence of recent acute exacerbation, however, enlargement suggests superimposed malignant disease.

The author concludes that measurement of the retrogastric space is of great value, sometimes revealing the first evidence of abnormality and often adding significance to minor changes in the antrum and duodenal loop. It is particularly useful in patients of thin and medium build, in whom abnormal measurements are virtually always significant. Forward displacement was erroneously diagnosed in 2 patients, both hyper-

sthenic, so that in the obese, in the absence of other findings, increase in the retrogastric space must be interpreted with caution.

Two diagrams; 2 tables.

CHARLES M. GREENWALD, M.D.
Iowa City, Iowa

HERNIA

Some Post-operative Findings in Hiatus Hernia. J. V. Sparks. *J. Fac. Radiologists* 9: 84-89, April 1958. (Bristol Royal Infirmary, Bristol, England)

The postoperative findings in 389 cases of hiatus hernia are reviewed: 333 axial (Type I) and 56 paraesophageal (Type II). Acid regurgitation was found preoperatively only in Type I cases. Five per cent of the hernias were demonstrated in the erect position, 20 per cent in the supine position, and 70 per cent in the oblique prone position. A few cases required special maneuvers for demonstration of the herniation.

The majority of the patients had been treated by hiatal repair through a left thoracotomy. Esophagogastrectomy was done in some instances of stricture formation.

Preoperative complicating factors were inflammatory changes, present in 50 per cent of Type I cases in contrast to only 3 of the 56 Type II cases; coincident gastric ulcers, present in both types; duodenal ulcers, present in only Type I cases. Neoplasms of the esophagus or stomach were found in 9 cases, in 3 of which there was no relation to the hernia.

As postoperative complications the author lists dysphagia, leakage at the site of suture, lung changes, recurrence, pain in the wound, and pylorospasm. Dysphagia is typically present the first two or three weeks following repair. Leakage at the suture line occurred only rarely but was responsible for 5 deaths. Pulmonary parenchymal changes were of frequent occurrence but were usually transient. In 38 cases there was recurrence of herniation through the hiatus. In addition there were 6 cases in children in whom, following esophagogastrectomy, a knuckle of colon had herniated lateral to the stomach, and 5 cases with a recurrent herniation through the incision in the dome. Pain in the wound was due to severance of the intercostal nerves. Pylorospasm was observed only rarely and was relieved by belladonna. In 35 cases reduction was incomplete.

Nineteen deaths occurred postoperatively, 5, as mentioned above, due to leakage at the suture line; 6 to pulmonary embolism; 2 to cardiac failure; 1 each to laryngeal edema, perforated gastric ulcer, subarachnoid hemorrhage, and uremia. In 2 cases the cause of death was not known.

Fourteen roentgenograms; 4 tables.

SAMUEL B. HAVESON, M.D.
University of California, S. F.

THE MUSCULOSKELETAL SYSTEM

Occult Fractures. Rudolph S. Reich and Norman J. Rosenberg. *J. A. M. A.* 166: 563-568, Feb. 8, 1958. (10900 Carnegie Ave., Cleveland 6, Ohio)

By definition, the occult fracture is "one which gives clinical signs of its presence but cannot be demonstrated by x-ray examination until reparative changes have occurred." In a large number of cases, especially without displacement, failure to demonstrate the fracture is

due to the fact that the involved area is not properly centered on the film. The careful clinician, examining an injured limb, should attempt to pinpoint a site of maximum tenderness and swelling. If he outlines this area with a skin pencil, it is of great help to the technician. The use of magnification technics or laminagraphy may confirm a doubtful diagnosis.

Even without roentgen demonstration it should be possible in most cases, especially when the surface of the bone is palpable, to recognize a fracture. Painful limitation of motion, point tenderness, and swelling, often with ecchymosis and a history of injury, are sufficient for diagnosis. In joint fractures the presence of fat droplets in the hemarthrosis is pathognomonic.

Eleven cases are reported.

Twenty-three roentgenograms.

An Analysis of Adult Skeletal Tuberculosis. Edward M. LaFond. *J. Bone & Joint Surg.* 40-A: 346-364, April 1958. (St. Mary's Bldg., St. Cloud, Minn.)

Data are presented from a series of 230 consecutive adult patients with proved, active skeletal tuberculosis seen in the period from 1928 to 1946. The course of the disease in that pre-streptomycin period is compared, on the basis of progress roentgenograms, with that in two other groups of patients, 196 and 21 cases, respectively, seen in the years 1947 to 1952 and treated with streptomycin.

The majority of the patients were young men and the disease was in most cases located in the weight-bearing joints, notably the spine, knees, hips, and feet. Lesions were usually advanced and associated with tuberculous disease of other systems. The mortality rate for all patients of the early series (followed for six to twenty-five years), due to tuberculosis, was 57 per cent. Mortality was related to location and extent of bone lesions and the presence of pulmonary tuberculosis.

Active destruction of bone tissue, the characteristic finding of tuberculous osteomyelitis, forms the basis for roentgenographic analysis of the course of the disease. Serial roentgenograms were judiciously used in the series treated with streptomycin in an effort to rate the effects of the drug objectively. No striking effects were noted. Spread of the bone infection or new bone lesions have been observed with the patient under treatment. Nevertheless, in the study of these relatively large series of cases a slight but definite improvement in osseous lesions was inferred.

Tuberculosis is a necrotizing disease and when well advanced in bony tissue causes defects that are difficult if not impossible to repair. The therapeutic effects of the drug, therefore, may not be apparent on roentgenograms of the bones. The effects on soft-tissue tuberculous lesions is often dramatic. On the basis of clinical and laboratory determinations, e.g., sedimentation rate, there is usually an improvement. It is felt that the ultimate effect on the relapse and mortality rate among patients with skeletal tuberculosis will, in time, be marked.

Six roentgenograms; 4 charts; 16 tables.

JOHN F. RIESSER, M.D.
Springfield, Ohio

Bone and Joint Changes in Haemophiliacs. Gabriel Stiris. *Acta radiol.* 49: 269-275, April 1958. (Roentgen Department, Rikshospitalet, Oslo, Norway)

The author presents a brief review of the pathology of bone and joint changes in hemophiliacs. The initial

hemarthrosis causes elevation of the intra-articular pressure, as a result of which the hematoma will attack the margin of the cartilage, penetrate toward the marrow spaces and cause erosion. Cysts in juxta-articular areas of bone are assumed to be caused by hemorrhage.

Thirty-five cases of hemophilia in patients ranging from three to seventy years of age were reviewed, in 30 of which there were clinical signs of articular hemorrhage. A majority gave a history of trauma. All but 1 patient had polyarticular involvement. The joints most commonly affected were the knee and elbow, followed by the ankle. Rarely were the shoulder, hip, finger, or toe joints involved.

Roentgen findings were erosion and cyst formation, the erosion generally occurring juxta-articularly. Cysts occurred in the majority of joints and were of varying size and located chiefly in the epiphyseal area. Large cortical defects were frequently found. The changes were usually bilateral.

Deformities occurred most frequently in the knee and elbow, with irregular articular outlines and diminished articular space. Ankylosis was observed only once; contractures were frequent. Hypertrophic joint capsules and increased density corresponding to the recesses were often observed.

Treatment varied from the use of blood and plasma transfusions in the majority to occasional utilization of irradiation for pain relief, and intra-articular injection of cortisone or hyaluronidase in 1 per cent procaine.

Nine roentgenograms.

GEORGE C. BARRETT, M.D.
Bowman Gray School of Medicine

Roentgenographic Abnormalities of the Skeletal System in Wilson's Disease (Hepatolenticular Degeneration). Nathaniel Finby and A. G. Bearn. *Am. J. Roentgenol.* 79: 603-611, April 1958. (The New York Hospital, 525 E. 68th St., New York 21, N. Y.)

Wilson's disease is an uncommon hereditary abnormality characterized by disturbances of copper metabolism leading to deposition of the metal in the brain and liver, with impairment and later degeneration of these organs. Skeletal abnormalities were demonstrable in 14 of 20 patients studied by the authors. Varying degrees of *osteomalacia* were observed in 7 patients, manifested by severe widespread bone demineralization or patchy areas of bone rarefaction or destruction tending to mimic rickets in younger individuals. Two patients showed the pseudofractures of Milkman characterized by transverse radiolucent bands in bone, with little or no callus formation. Skeletal maturation tended to be retarded. *Bone fragmentation* was evident in 9 cases at the joint margins, most frequently in the wrists and hands. *Osteoarthritis* with cartilage injury was noted in 11 of the 20 patients. The changes were sometimes severe in relatively youthful individuals. Other osseous abnormalities of miscellaneous types, mainly increased fracture incidence, were exhibited in 7 of the patients. This tendency to trauma seemed related to the spasticity, tremor, and neurologic disturbances of the disease, as well as to an apparent disease-related bone fragility. Incidental findings of osteomata or bone islands were encountered in 7 of the 20 patients.

Clinical and laboratory findings are briefly reviewed. The most important features of the disease are disturbance of phosphate metabolism with excessive excretion,

increased urinary excretion of copper, and a disproportionate decrease in the serum ceruloplasmin. The remarkable similarity to certain aspects of Fanconi's syndrome is noted.

Fifteen roentgenograms demonstrate favorably the points under discussion. One table is presented, showing the major features of the disease in tabular form.

JAMES W. BARBER, M.D.
Cheyenne, Wyo.

Bone Lesions Associated with Villonodular Synovitis. Charles W. Breimer and Robert H. Freiburger. *Am. J. Roentgenol.* 79: 618-629, April 1958. (535 E. 70th St., New York 21, N. Y.)

Two forms of villonodular synovitis occur: a circumscribed form in which single or multiple polypoid masses are attached to the synovia and a diffuse form in which there is hyperplasia of all synovial villi and the entire synovial surface has a mossy or bearded appearance. Microscopically there is a mixture of closely compacted polyhedral stromal cells, giant cells, and histiocytes containing cholesterol and hemosiderin, interspersed with areas of collagen and hyaline degeneration. The term "pigmented villonodular synovitis" is used when larger amounts of hemosiderin are present. In the authors' series of 9 cases all the bone lesions were associated with the diffuse form of the condition.

The diagnosis of villonodular synovitis with or without bone lesions should be based on the following criteria: (1) monarticular involvement; (2) normal preservation of the joint space; (3) normal mineralization of juxta-articular bone; (4) nodular intra-articular synovial swelling; (5) lack of calcification within the soft-tissue masses; (6) absence of systemic disease; (7) chronicity, with duration of symptoms from several months to several years, with relatively little pain in the affected joint and little if any limitation of motion.

Bone lesions appear at the involved joint as sharply circumscribed erosions and single or multiple cysts having thin sclerotic margins. To be differentiated are tuberculous arthritis and caries sicca, synoviomia, osteoarthritis, rheumatoid arthritis, and gout.

Twenty-one roentgenograms; 2 photomicrographs.

ROBERT S. ORMOND, M.D.
The Henry Ford Hospital

Traumatic Periostitis in Infants and Children. Morris S. Friedman. *J.A.M.A.* 166: 1840-1845, April 12, 1958. (105 E. Jefferson Blvd., South Bend 1, Ind.)

Roentgenographic evidence of periostitis may be found in children up to ten years of age with pain and other symptoms, without obvious explanation. Careful inquiry in such cases may reveal forgotten trauma or possibly a birth injury with periosteal stripping.

Relatively trivial trauma may cause periosteal hemorrhage and extensive periosteal stripping in the young child. Calcification and formation of new bone may be demonstrated roentgenographically after the organization of subperiosteal hematoma. The new periosteal bone involves only the shaft and never extends beyond the epiphyseal line. In the roentgenogram the "subperiosteal cloaking" may appear as a faint line along the shaft or may be massive enough to resemble the calcified subperiosteal hematoma of scurvy. Differentiation must also be made from syphilis, bone tumor, and infection.

Ten cases are reported to illustrate the clinical and roentgenologic manifestations of traumatic periostitis and

show how this condition may be confused with other diseases.

Eleven roentgenograms.

GORDON L. BARTEK, M.D.
Grand Rapids, Mich.

Juxtacortical Osteogenic Sarcoma. Billy P. Sammons, S. S. Sarkisian, and M. C. Krepela. *Am. J. Roentgenol.* **79**: 592-597, April 1958. (Radiological Service, U. S. Naval Hospital, St. Albans, N. Y.)

The distinct pathologic entity juxtacortical osteogenic sarcoma has in the past been known as parosteal osteoma or sarcoma, or periosteal osteogenic sarcoma. The lesion has undoubtedly masqueraded as "atypical osteochondroma" or a "recurring form of myositis ossificans."

This particular sarcoma differs in two important aspects from the more common osteogenic sarcoma: a relatively benign course and more favorable prognosis, as well as a strong tendency toward absence of symptoms in the early stages. Characteristically the juxtacortical sarcoma appears on the distal posterior aspect of the femur in young adults, presenting as a largely asymptomatic mass with slow growth over a prolonged period. Radiographic findings are reasonably characteristic—a densely calcified, lobulated mass with interspersed areas of lucency. The bony cortex is encroached upon and sclerotic but not invaded. The medullary canal is not involved. Periosteal new bone is formed at the periphery of the lesion, so that Codman's triangle is ordinarily found. The periphery of the tumor tends to be well demarcated from the adjacent tissues.

The lesion shows a strong tendency to recur following incomplete local excision. Subsequent recurrences become more and more frankly malignant and invasive, with metastases to the lungs in later stages.

The authors believe that proper therapy may be limited to local excision if the tumor can be widely removed with inclusion of adjacent normal tissues. Frequently, because of its early asymptomatic nature, it is not found until it is well advanced, at which time amputation is the only safe course.

One illustrative case is presented.

Three roentgenograms; 3 photomicrographs; 2 photographs.

JAMES W. BARBER, M.D.
Cheyenne, Wyo.

Roentgenologic Aspects of Benign Chondroblastoma of Bone. George E. Plum and David G. Pugh. *Am. J. Roentgenol.* **79**: 584-591, April 1958. (Mayo Clinic, Rochester, Minn.)

The medical records of 17 cases of chondroblastoma seen at the Mayo Clinic were reviewed by the authors and the gross and microscopic pathological features were compared with the roentgen findings. The age incidence ranged from eight to fifty-nine years, and of the 17 patients studied, 10 were males. Pain was the most common symptom, occurring in 16 patients. Tumor and limp were complaints in 7 and 6 patients, respectively.

In 4 pathological specimens including the entire tumor, the neoplastic tissue was seen to be sharply demarcated from the surrounding normal bone by a thin margin of sclerotic bone which was either smooth or slightly ridged but was without gross bony trabeculation. In none of the resected specimens did neoplastic tissue infiltrate adjacent soft tissues. There was no evidence of malignant transformation.

All but 6 tumors reported in the literature as benign chondroblastoma were in the long bones. Of the authors' 17 cases, 7 involved the pelvis, scapula, and rib, sites not previously reported in the literature.

The most characteristic roentgenographic feature was a central area of destruction sharply limited from the surrounding normal bone, usually by a thin margin of increased density of bone. When it involved the long bones, the tumor almost always affected the epiphysis and frequently the adjacent shaft. Trabeculation and active periosteal reaction were rarely seen. A smooth well outlined soft-tissue mass is frequently demonstrable when a large tumor has destroyed the overlying cortical bone by pressure erosion.

The most important lesions which should be considered in differential diagnosis, roentgenographically and pathologically, are enchondroma, chondromyxoid fibroma (which seems to be closely related to benign chondroblastoma), chondrosarcoma, and giant-cell tumor. In all instances the roentgenologist should be informed of any previous diagnosis and therapy before rendering an opinion about such a lesion. The treatment of choice is surgical curettage.

Seven roentgenograms.

ROBERT H. LEAMING, M.D.
Memorial Center, New York

Solitary Plasma Cell Myeloma with New Bone Formation. Hans Lewin and Joseph M. Stein. *Am. J. Roentgenol.* **79**: 630-637, April 1958. (Winter VA Hospital, Topeka, Kans.)

The authors report a case of solitary plasma-cell myeloma of the eighth, ninth, and tenth thoracic vertebrae which showed a high degree of hypercalcification and new bone formation in the presence of typical osteolytic changes. Diagnosis was confirmed by laminectomy and removal of extramedullary tissue. The patient was followed for four years without evidence of development of disease elsewhere. Bence Jones protein studies and sternal marrow smears were constantly negative.

The authors reviewed the literature and were able to find only one other case in which productive changes were described associated with multiple myeloma.

Ten roentgenograms; 1 photomicrograph.

ROBERT S. ORMOND, M.D.
The Henry Ford Hospital

Cysticercosis: Multiple Infarcts and Necrosis in Bone. Michael Lenczner and D. G. Wollin. *Canad. M. A. J.* **78**: 344-345, March 1, 1958. (Toronto General Hospital, Toronto, Ont., Canada)

A case of cysticercosis associated with multiple infarction and necrosis of bone, demonstrable roentgenographically, is described. The coincidence of cysticercosis and bone infarction suggests the deposition of the larvae in the vessels of the bones involved. Biopsy was not done, since a needle biopsy could be expected to reveal only necrotic infarcted bone and a surgical biopsy involved the risk of complications in a patient having no symptoms referable to the cysticercosis.

Four roentgenograms.

The Roentgenologic Criteria for Appraising the Human Back as an Economic Asset or Liability. George W. Henry, Ivar J. Larsen, and Steele F. Stewart. *Am. J. Roentgenol.* **79**: 658-672, April 1958. (1133 Punchbowl, Honolulu 13, Hawaii)

Pre-employment roentgenographic examination of

the lumbosacral spine is an economic advantage to both employee and employer. By avoidance of stress on backs that are structurally unstable, the risk of expensive breakdown is minimized. The only satisfactory method of making an appraisal of the hidden parts of the spine is by roentgenography. The authors have made such a study of 6,010 individuals in the past fourteen years, using a concurrent series of patients complaining of backache for statistical comparison.

The minimum roentgen examination of the lumbosacral spine includes: (1) an anteroposterior view of the lumbar spine and sacrum centered just above the iliac crests; (2) an anteroposterior view with the back flattened on the table by hip-knee flexion, the knees spread, and the central beam angled 20 degrees toward the head, centered on the lumbosacral junction; (3) an erect lateral roentgenogram centered over the lumbosacral junction; this must include at least the third lumbar vertebra and the upper half of the sacrum. Fixation bands are mandatory for roentgenography in the lateral view. Additional films are obtained as needed to resolve any doubt.

On the basis of roentgenographic studies of the lumbosacral spine, applicants are graded as good, fair, and poor risks. The fourth and fifth lumbar and first sacral segments are of critical interest. Irregularities or abnormalities here are regarded as of high importance. This is particularly so in applicants under thirty years of age, where every sign of stress, wear, and tear is considered significant. The following general criteria are applied, though sensible medical judgment modifies the decision in each case.

A. Good risk (employable for any job requiring physical strain or effort).

1. Normal findings.
2. Atavistic changes.
3. Limbus body.
4. Four or six lumbar vertebrae.
5. Ununited epiphysis of the pars interarticularis.
6. Mild asymmetry of the zygapophysial facets.
7. Small spina bifida occulta.
8. Schmorl's nodules in upper lumbar spine.
9. Transitional lumbosacral vertebrae with solid fusion of one or both transverse processes.
10. "Increased" lumbar lordosis.

B. Fair risk (defects of such a nature as to permit employment for labor but not for repetitious or continuous heavy low back work).

1. Appreciable asymmetry of the zygapophysial facets.
2. Moderate spina bifida occulta.
3. Schmorl's nodules at the L-4 or L-5 level.
4. Moderate degenerative changes in the upper lumbar spine, or small vertebral body spurs in lower areas.

C. Poor risk (defects of such a magnitude as to render heavy lifting or labor inadvisable).

1. Spondylodysgenesis (spondylolysis) or spondylolisthesis.
2. Transitional lumbosacral vertebrae having transverse process articulations with the ala of the sacrum.
3. Thin intervertebral disk space at the L-4-5 or lumbosacral level.
4. Marked general hypertrophic degenerative changes in the upper spine, moderate if at the L-4, L-5, or S-1 level, and mild if at this lower level in a young applicant.

5. Wedged vertebra.
6. Hemangioma or neoplasm of any form.
7. Extensive spina bifida occulta.
8. "Clasp knife" deformity.
9. Combinations of other changes, as asymmetry of zygapophysial facets plus degenerative changes.
10. Evidence of previous surgery, myelography, previous infection, Marie-Strümpell spondylitis, disease as osteoporosis, other gross congenital anomalies as hemivertebra, etc.

Nineteen roentgenograms; 1 diagram.

ROBERT S. ORMOND, M.D.
The Henry Ford Hospital

Cervical Diskography: Technique, Indications and Use in Diagnosis of Ruptured Cervical Disks. Ralph B. Cloward. *Am. J. Roentgenol.* 79: 563-574, April 1958. (388 Alexander Young Bldg., Honolulu 13, Hawaii)

The author reports his experience with 41 clinical cases upon which cervical diskography was performed over an eighteen month period. The clinical findings were evaluated along with the roentgen findings in each case. From these 41 cases as well as 400 patients in whom lumbar diskography has been performed, the author reaches the following conclusions: 1. Diskography may yield diagnostic information not revealed by myelography. 2. When the examination is properly performed, the normal disk is not injured by needle puncture. 3. The pain induced by disk injection is a valuable localizing sign.

Injuries to the intervertebral disks occur primarily in the lumbar and cervical spine in the ratio of about 30 to 1. Since most of the cervical disk pathology involves C5-C6 and C6-C7, these disks are usually studied.

The nucleus pulposus is injected through an antero-lateral approach and, after adequate roentgen localization of the needle, either 50 per cent Hypaque or 70 per cent Urokon is injected. The maximum amount to be injected in a ruptured or degenerated cervical disk is 0.5 c.c. The normal nucleus pulposus of a cervical disk will accept only 0.2 to 0.3 c.c. Stereoscopic exposures are made with the needle in place and after its removal.

The author recognizes three types of pathological cervical disks:

1. Early disk rupture, the so-called soft disk often seen following whiplash injury. Plain films are often negative except for a loss of the normal lordotic curve. There is commonly a posterior rupture permitting extrusion beyond the posterior limits of the nucleus pulposus.

2. Degenerative disks of long standing. Such cases usually show joint narrowing and bone proliferation on the plain films. Diskographic findings in these patients often demonstrate soft-tissue lesions within the spinal canal much longer than would have been anticipated from the plain films or the myelogram.

3. Massive disk protrusion into the spinal canal. Myelographically this simulates cervical cord neoplasm. The diskogram aids in differential diagnosis.

Foretelling the possible objection that puncture and injection of a normal disk is potentially dangerous, the author states that after six years experience with lumbar diskography he has yet to encounter a single case in which it was suspected that the procedure resulted in symptoms of disk rupture at a later date. He believes that injury to the cervical disks with the technic described may be even less likely.

Diskography undoubtedly is a useful diagnostic procedure in so-called whiplash injury, brachial neuritis and cervical cord lesions such as primary lateral sclerosis, multiple sclerosis, tumor, etc., all of which may simulate cervical intervertebral disk protrusion.

Twelve roentgenograms; 1 photograph; 1 diagram.

ROBERT H. LEAMING, M.D.
Memorial Center, New York

Diagnostic Radiology and Low Back Pain. A. J. M. Griffiths. *Canad. M. A. J.* 78: 398-401, March 15, 1958. (St. Martha's Hospital, Antigonish, Nova Scotia, Canada)

In the first three months of 1956, 316 lumbosacral spine examinations were performed at the University of Alberta Hospital, Edmonton, for a variety of indications. It was possible to review the films of 302 of these cases. The findings in these were as follows:

Negative.....	106
Osteoarthritis.....	68
Disk degeneration.....	36
Trauma (recent).....	17
Congenital anomalies.....	17
Spondylolisthesis.....	13
Spinal fusion.....	10
Porotic wedging.....	7
Others.....	28

In 191 cases (65 per cent) the examination admittedly did not help the clinician make a diagnosis for which specific relief could be offered to the patient.

The author stresses that roentgenography is not an infallible means of producing a definite solution to a diagnostic problem involving back pain. Spur formation, disk narrowing, and vertebral margin sclerosis may be the results of a symptom-producing process and not necessarily the cause of symptoms. There is reason to believe that many congenital anomalies are not of clinical significance. Secondary deposits may reach a considerable size before there is radiological evidence of their presence. Many traumatic lesions are confined to ligaments and cannot be shown on plain films. A considerable period of time may elapse before secondary bone changes confirm the occurrence of injury in the past. The significance of such lesions as osteitis condensans ilii is still in dispute. Negative roentgen reports should be accepted with reserve.

It is concluded that the radiologist has to weigh the probabilities just as much as does the clinician, and that he should be aware of, and willing to acknowledge, or even emphasize his limitations. His standing with his colleagues will not suffer by so doing.

Nine tables.

Roentgenographic Abnormalities in Soldiers with Low Back Pain: A Comparative Study. Frederick J. Fischer, Murray M. Friedman, and Robert E. Van Demark. *Am. J. Roentgenol.* 79: 673-676, April 1958. (R. E. Van D., 303 S. Minnesota Ave., Sioux Falls, S. D.)

This study comprises an analysis of 200 male soldiers complaining of low back pain. No attempt was made to correlate the symptoms with roentgen findings. A second group of 100 male soldiers with no complaints referable to the back was analyzed for comparison. With the exception of neural arch defect, which occurred two and one-half times as frequently in the symptomatic group (14.5 per cent) as in the control group, there

was little difference between the groups. The percentage of spines showing no variation from the normal was the same for both (20 per cent).

Two roentgenograms; 1 table.

ROBERT S. ORMOND, M.D.
The Henry Ford Hospital

Infections of Vertebral Interspaces After Operations on Intervertebral Disks. C. Roger Sullivan, William H. Bickel, and Hendrik J. Svien. *J. A.M.A.* 166: 1973-1977, April 19, 1958. (Mayo Clinic, Rochester, Minn.)

A study was made of 11 patients who had undergone surgical removal of a nucleus pulposus and subsequently revealed symptoms of intervertebral space infection. The diagnosis may be difficult, since fever may be absent and the complaints may not differ from those attendant upon any spinal operation. The most characteristic symptom is severe pain in the lumbar spine, occurring from a few days to as late as ten weeks after operation. Antibiotics did not alter the course in the authors' patients.

Roentgenographic findings consisted of a "fuzziness" of the ordinarily dense white epiphyseal plates adjacent to the involved interspace. Narrowing of the space followed, with proliferation of new bone around the periphery of the joint, mostly on the anterolateral aspects of the centrum. These beaks of new bone, which resemble the osteophytes of osteoarthritis, eventually coalesce and form firm bony intercorporeal fusion occurs. The earliest roentgenogram in the authors' series was obtained eight weeks after surgery. This showed evidence of destruction. Fusion occurs inevitably in six months to two years.

Laboratory diagnosis can be made by aspiration of material from the joint space. Treatment consists of immobilization by cast or Taylor brace until there is roentgen evidence of fusion.

Three case histories illustrate the condition.

Eight roentgenograms.

GORDON L. BARTEK, M.D.
Grand Rapids, Mich.

The Lumbosacral Spine in Multiple Myeloma. William S. Smith and Thomas J. Klug. *Arch. Surg.* 76: 639-643, April 1958. (University Hospital, Columbus 10, Ohio)

Radiographic findings in the spines of 58 patients with proved multiple myeloma are described and summarized. Fifty per cent of these patients entered the hospital with complaints of back pain.

The major findings are divided into three groups: (1) normal, or only mild osteoporosis; (2) definite osteoporosis but no other demonstrable spine lesions; (3) osteoporosis with compression fractures or lytic lesions, or both. Approximately a third of the cases fell into each of these three groups; 59 per cent of the patients showed either normal spines or osteoporosis only. Definite lytic spinal lesions were demonstrable in only 10 per cent of the cases. Some patients dying of their disease fail to manifest any roentgenographic changes in the skeleton. On the other hand, progression from an apparently normal spine to one with widespread lytic lesions may develop within a few months. In this particular series a little over half the cases showed punched-out lesions of the skull of the classic type associated with this disease. As might be expected, the more severe the roentgen changes in the spine the

likely the patient was to complain of backache. The conclusion is that back pain with osteoporosis is enough to suggest the diagnosis of multiple myeloma, especially in patients over forty years of age.—J. W. B. If one awaits development of characteristic punched-out lytic lesions, many cases will be missed. See roentgenograms; 1 diagram; 1 table.

JAMES W. BARBER, M.D.
Cheyenne, Wyo.

Core of the Infant with Congenital Subluxation of the Hip

Paul C. Colonna. J.A.M.A. 166: 715-720, Feb. 1958. (3400 Spruce St., Philadelphia, Penna.)

The author has reviewed the records of 45 infants with clinical or roentgen evidence suggesting congenital dislocation of one or both hips seen at the Hospital of the University of Pennsylvania during the five-year period 1952-1957. Fifty-two hips were involved. A sharp distinction is drawn between subluxation and dislocation of the hip. This paper is concerned chiefly with 38 infants with subluxation, all under eighteen months of age and all treated conservatively by splints or plasters. Of these, 36 (91.7 per cent) finally had functionally and anatomically normal hips.

It is stated that if an occasional suspected case is mistakenly treated by braces or plaster for a few months for congenital dislocation or subluxation, no great harm has been done, but if even a few of the true dysplasias are neglected or not recognized, permanent fixed deformities will result and some degree of deformity will occur in later life. This is counter to the opinion of Caffey (Pediatrics 17: 632, 1956. Abst. in Radiology 68: 55, 1957), who concluded that the current practice of diagnosing a predislocation phase of congenital hip dislocation from radiologically enlarged acetabular angles or the clinical signs noted, and instituting prophylactic therapy on this basis, is erroneous and should be discouraged.

The present author feels one should be suspicious of dysplasia if the acetabular index measures more than 35° in the first three postnatal months or more than 25° in the first six months of life. The femoral nucleus of the normal hip should be roentgenologically visible in the first three months after birth. In infants with hip dysplasia, it is not ordinarily found so early, but has been seen by the author as early as at the age of two months and even later than eight months.

The use of gradual abduction is considered the method of choice in correcting congenital subluxation of the hip. The Carruthers-Freiberg splint is the most frequently used appliance. Roentgenograms will show the essential feature of forcing the femoral head deep into the socket and retaining it against the floor of the acetabulum, permitting an adequate roof to develop which relieved of the head pressure against the limbus. The time interval varies from a few months in the mild cases to as long as twenty-four months. The roentgenogram—an occasional single anteroposterior exposure—may be the yardstick for measuring the time necessary for retaining the head in the reduced position.

Seven roentgenograms; 1 photograph; 3 diagrams.

Abnormality of the Long Bones and Progressive

Muscular Dystrophy in a Family. E. W. Henry, N. L. Argland, H. W. McIntosh, and D. E. Starr. Canad. M. A. J. 78: 331-336, March 1, 1958. (Vancouver General Hospital, Vancouver, B. C., Canada)

The authors report 6 cases in 3 generations of a

family in which bone disease was associated with muscular weakness. Six fractures of long bones followed by delayed union occurred in 4 males and resulted in the amputation of 4 limbs. In one case there was progressive muscular dystrophy of late onset (twenty-five years) affecting the limbs and trunk; in another wasting was confined to the lower part of both quadriceps; in a third there was radiologic evidence of marked wasting of the upper limbs. There was said to be muscular weakness and wasting in 2 patients not under the care of the authors.

There was no generalized muscular weakness in 2 cases, but roentgenograms showed a reduction in diameter of the medullary cavity in the shaft of the long bones, especially the humerus and femur. The cortex appeared to be relatively increased in width. The cortex to medulla ratio as measured on x-ray films was 2.6:1 and 2.8:1. In 20 normal persons this ratio ranged from 0.4:1 to 1.9:1.

Rarefaction of the involved bones, pathologically resembling an irregular osteoporotic process, resulted in bizarre radiologic appearances with coarse trabeculation which in one instance suggested Paget's disease. Generalized osteoporosis of bone was a late finding, occurring in association with a considerable degree of muscle wasting and inactivity.

The bony abnormality appeared to be inherited as a sex-limited dominant characteristic. The possibility that it represented in this family part of a hereditary mesenchymal defect, in association with muscular dystrophy, cannot be excluded.

Six roentgenograms; 2 photomicrographs; 1 chart.

Metastatic Tumors of the Hand. Robert Kerin. J. Bone & Joint Surg. 40-A: 263-277, April 1958. (445 Hart St., New Britain, Conn.)

Metastatic tumors of the hand are of uncommon occurrence. Search of the literature yielded 23 case reports but in 7 of these the primary site was not specified. The author presents 7 new cases.

Bronchogenic carcinoma is the most frequent invader of the hand, and often the metastasis is the first indication that there is a tumor in the lung. The lesions are believed to be blood-borne and other sources are cancers of breast, adrenals, kidneys, prostate, and bowel. One of the author's cases was secondary to epidermoid carcinoma of the skin of the foot.

Roentgenographically the principal finding is an osteolytic lesion involving one or more of the tubular bones of the hand, sparing the adjacent joints. The carpals are involved rarely. In most cases the diagnosis of felon, osteomyelitis, or other inflammatory process is made before the true character of the lesion is recognized by biopsy.

Differential diagnosis concerns tuberculous dactylitis, enchondroma, epidermoid cyst, osteoid osteoma, giant-cell tumor, simple bone cyst and primary malignant tumors of the bones of the hand. Primary malignant tumors are extremely rare but osteogenic sarcoma has been reported. In such cases roentgenograms reveal an osteolytic and osteoblastic lesion. The laying down of new bone should serve for differentiation from a lytic metastasis.

Therapy is largely symptomatic and surgical.

Seventeen roentgenograms; 10 photomicrographs; 1 photograph; 1 diagram; 1 table.

JOHN F. RIESSER, M.D.
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GYNECOLOGY AND OBSTETRICS

Double-Contrast Method for Examination of the Uterine Cavity. I. Roentgen-Anatomic Study. P. Deák, L. Fried, and A. Bäder. *Forstchr. a. d. Geb. d. Röntgenstrahlen* 88: 422-426, April 1958. (In German) (Péterfy Sándor Poliklinik, Budapest, Hungary)

Ordinary hystero-grams obtained with iodine solutions give only limited information, according to the authors, since slight changes are obscured by the opacity of the contrast material. For obtaining finer details, a double-contrast method resulting in mucosal relief was used in autopsy or surgically removed specimens of uteri.

Up to 3 c.c. of a water-soluble iodine solution is slowly injected into the uterine cavity. The solution is then aspirated and replaced by an equal amount of air. Following this, a thin layer of contrast material clings to the mucosal surface of the uterine cavity so that a double-contrast roentgenogram can be obtained.

This method has yielded valuable information in addition to findings on routine hystero-graphy. Illustrative of the results are a case of hypertrophied mucosal glands which had simulated endometrial hyperplasia on ordinary hystero-grams, mucosal defects in a myomatous uterus, and a cervical polyp which could not be discovered by any other type of examination.

The authors conclude that this procedure is helpful in detecting small intrauterine lesions, as well as determining their exact location and extent. This is an achievement which could not be accomplished by any other means. Clinical applications of the method will be reported later.

Thirteen roentgenograms.

ERNEST KRAFT, M.D.
Northport, N. Y.

A Review of 400 Hysterosalpingograms. Eugene T. Ellison, Wm. D. Thornton, and Cyrus P. Klein. *J. Arkansas M. Soc.* 54: 467-469, April 1958. (Collom & Carney Clinic, Texarkana, Ark.)

Of 400 hysterosalpingograms obtained in 330 women, 186 showed the uterus and tubes to be normal, with evidence of peritoneal spill of the medium, and 40 were considered technically inadequate. In 15 cases the oil failed to pass into the fallopian tubes, in 21 there was definite obstruction at the fimbriae, and in 19 a definite diagnosis of hydrosalpinx was made. Spill into the peritoneum through one fallopian tube was seen in 45 patients, lateral displacement of the uterus suggesting adnexal pathology in 7, bicornate uteri in 4, and growths in 9 (6 submucous fibroids, 1 diverticulum, and 2 polyps). Some clinically obvious fibroids did not show up on the roentgenogram. Multiple tests were made in 42 cases. Complications were relatively rare and included pain requiring sedation in 15 patients, immediate inflammatory processes in 3, and clinically insignificant oil granulomas in 3. Subsequent findings of occluded tubes in 4 cases and of endometriosis in 4 were considered to be of a debatable nature.

One hundred five pregnancies were known to have occurred subsequent to the procedure. Of these, 20 resulted in miscarriages. In 11 cases, hysterectomy was advised on the basis of the roentgen findings. In addition, hysterosalpingography was felt to have been of definite psychological value to many childless couples and others desirous of more children.

Four tables.

THE GENITOURINARY SYSTEM

Renal Papillary Necrosis: Roentgenologic Diagnosis and Formation of Calculi. Curt Lagergren and Nils Lindvall. *Acta radiol.* 49: 249-268, April 1958. (Roentgendiagnostic Department, Karolinska Sjukhuset, Stockholm, Sweden)

The authors add 55 cases of renal papillary necrosis to the 194 cases previously (1953) collected from the literature. One case was proved by autopsy and had had no urograms. Of the 54 remaining cases, 52 showed typical appearances either on urography or pyelography. These changes are described as of two forms: (1) a medullary form in which the cavity is seen in the apex of the renal papilla while the fornix of the calyx remains intact for a longer period; (2) a papillary form, in which there is a typical "ring shadow" where the papilla has been detached. In the latter form, when the papilla has been resorbed or passed, a cavity with a wide base forms. The typical radiologic features are not evident until detachment has begun and the contrast medium enters the necrotic areas. Previously, enlargement of the kidneys has been considered a typical roentgenologic feature. In the present series, however, the renal shadows were normal or contracted.

A survey of the literature is presented. Of associated factors, 5 categories are described: (1) primary vascular changes in the kidney; (2) pressure on papillary vessels; (3) cardiac insufficiency; (4) toxic impairment of the tissue by bacterial toxins or drugs; (5) allergic reactions. In practically all of these broad categories, infection of the urinary tract is almost invariably present. Previously it was thought that diabetes mellitus was a predisposing factor but in the present series only 11 patients were diabetics.

The diagnosis was made by intravenous pyelography in the majority of the 54 cases. It was confirmed by biopsy in 20 cases, by examination of passed papillary fragments in 7 cases, by microradiography of calculi in 6 cases, by autopsy in 3 cases, and by examination of the removed kidney in 4 cases.

Conditions entering into the roentgenologic differential diagnosis include renal tuberculosis, pyelonephritis, hypoplasia, calyceal diverticula and "medullary spongy kidney."

The pathogenesis of the detached papilla is discussed. There is a marked tendency for precipitation of salts around the papillary fragment. The high occurrence of urinary infection would also account for increased formation of calculi, but the incidence of calculi in 21 of the 55 cases (38 per cent) is considered by the authors to be higher than would be explained on the basis of infection alone.

Seven case summaries are presented with accompanying urograms or pyelograms and also microradiograms of associated calculi. In the microradiograms are demonstrated papillary fragments within the calculi.

Twenty-two roentgenograms; 6 microradiograms.
DAVID H. NEWBERN, M.D.
Bowman Gray School of Medicine

Primary Pneumaturia with a Report of a Case Diagnosed Radiologically. R. Glyn Thomas and A. Sandler. *South African M. J.* 32: 309-311, March 22, 1958. (Johannesburg Hospital, Johannesburg, Union of South Africa)

Primary pneumaturia is a rare phenomenon. It

occurs slightly more commonly in diabetics than in nondiabetics and is usually due to coliform bacillus infection. The radiological features to be noted are: (1) a round or pyriform translucency in the suprapubic midline area, distinguishable from the sigmoid and rectal gas shadows; (2) a pelvic fluid level with gas cap above it when a horizontal x-ray beam is used with the patient in the erect position; (3) pooling of the opaque medium on excretory urography, in the dependent portion of the bladder in the supine position, giving the appearance of a poorly defined "blob of opacity," surrounded

by a broad halo of translucent gas; in the erect posture a fluid level at the upper limit of the urographic medium, with gas cap completing the bladder outline.

Any translucencies in the region of the urinary bladder in the plain abdominal film should raise suspicion of gas in the bladder, particularly if bowel shadows can be separately distinguished. Often it is impossible to distinguish between bowel and bladder gas, and catheterization must be resorted to as the final arbiter.

A case is reported.

One roentgenogram.

RADIOTHERAPY

Dose Distribution in the Roentgen Treatment of Tumours of the Cerebral Hemispheres with Multi-field Technique. Martin Lindgren. *Acta radiol.* 49: 285-307, April 1958. (Department of Radiotherapy, University Hospital, Lund, Sweden)

The author investigated possible means of improving dose distribution in the treatment of cerebral gliomas, since postmortem examination of irradiated brains showed changes suggesting overdosage in superficial regions of the cerebrum following treatment by their usual 4-field technic, delivering approximately 4,000 r skin dose to each field. Intracranial dose measurements were made with microcondenser chambers placed at points along six sagittal planes within a human skull phantom with brain and scalp replaced with tissue-equivalent material. The factors used were: 170 kv; focus-skin distance 50 cm.; filter 0.5 mm. Cu plus 1 mm. Al; h.v.l. 1 mm. Cu. The radiation was delivered through four standard fields, each 6×6 cm., placed 5 mm. apart over one hemisphere. An imaginary tumor of 3 cm. diameter was indicated in the anterior half of the hemisphere.

Isodose curves were plotted in frontal and horizontal planes and these demonstrated that the maximal dose exceeded the minimum tumor dose by as much as 70 per cent. Dosage within the tumor was also uneven, varying 25 per cent between maximum and minimum.

Various changes in technic were investigated in an attempt to improve the distribution of dose:

(1) *Varying the skin dose delivered to the different fields:* This did not significantly alter the depth dose distribution.

(2) *Change in shape and position of the fields:* Cutting off the four adjacent corners reduced the "hot spot" dose somewhat and moved it closer to the tumor. Rearranging the position of the fields over the hemisphere produced a considerable improvement in ratio between "hot spot" and tumor dose but did reduce the total tumor dose.

(3) *The use of harder radiation* diminished the risk of underdosage to deeper parts of the tumor and improved dose distribution in the region of the tumor, as well as reducing the dose absorbed in the calvarium.

The improvements mentioned are only moderate, and the author feels that radical changes in technic—as to stationary or rotational supervoltage methods—may be necessary before any striking improvement can be obtained.

Fourteen figures, including 2 roentgenograms; 5 tables.

DAMON D. BLAKE, M.D.

Bowman Gray School of Medicine

Primary Carcinoma of the Vagina: Results of Treatment by Radiation. Charles A. Hunter, Jr. *J. Kansas M. Soc.* 49: 106-110, March 1958. (University of Kansas Medical Center, 39th and Rainbow Sts., Kansas City 12, Kans.)

In the twenty-five year period 1932 to 1957, 1,512 patients with gynecologic cancer were admitted to the University of Kansas Medical Center. Thirty-three proved cases of primary carcinoma of the vagina (2.2 per cent) were treated, 32 by radiation alone and 1 by radical pelvic surgery followed by deep roentgen therapy. All 33 of these carcinomas were of the epidermoid type. The ages of the patients ranged from thirty-two to eighty-four years, and approximately three-fourths of them had delivered children. The most common site was the upper third of the vagina.

Six patients received only external deep x-ray therapy to the pelvis. Three were treated by external deep x-ray therapy to the pelvis plus intravaginal x-ray therapy. One was treated by intravaginal radium application alone. The amount of radiation given varied widely.

Complications resulting from therapy were relatively high. Radiation sickness was marked in 9 patients. In 4 there was subsequent development of rectovaginal fistula, and in 3 of vesicovaginal fistula. In 1 patient a large perirectal abscess developed. Five were subjected to colostomy as a palliative procedure.

The five-year survival rate among the 27 "eligible" cases in this series is 25.9 per cent. If the 2 patients who are alive but with evidence of cancer are excluded, the absolute five-year "cure" rate would be 18.5 per cent, "a shockingly low" figure. The complete extirpation of all cancer-involved tissues, when applicable, is recommended as primary treatment for this condition. Radiation therapy should be reserved for cases not amenable to radical surgical procedures.

Four photomicrographs; 3 tables.

Expectations from Partial Body Irradiation in Cases with Generalized Metastatic Lesions. Wilhelm Albrecht Dalicho. *Strahlentherapie* 105: 592-599, April 1958. (In German) (Strahlenklinik, Gera, Germany)

In the city of Gera, Germany, all tumor cases have to be reported. Among the new cases listed from 1953 until 1955, 38.4 to 47.2 per cent were already in the third or fourth stage, with local and/or distant spread. For palliative purposes these hopeless cases have been exposed to partial body irradiation in addition to local therapy.

Radiation was given through two opposing fields of 1,600 sq. cm. and more, at distances ranging from 90

cm. to 3 meters, with single doses of 25 to 50 r from one to five times per week. The total dose of a series was from 500 to 1,500 r given to two fields. The treatments were, generally speaking, well tolerated, and there was little change in blood findings.

Forty cases with metastatic spread to distant organs and/or bones have been analyzed statistically, 20 breast cancers, 14 tumors of female genital organs, 2 cases of hypernephroma, and single cases of rectal carcinoma, reticulum-cell sarcoma of the coccyx, myosarcoma of the uterus, and seminoma.

Sarcoma cases showed a good response, while the results varied in the carcinoma group. Five cases were incompletely treated because of a rapid downhill course; 8 terminated fatally within the first six months and 7 in the second six months. The longest survival was four years and the shortest two months after the beginning of therapy. There were 3 two-year surviv-

als. In 12 cases (30 per cent) there was regression of the growth, and in 17 cases subjective improvement was observed. In metastatic lesions to bones the results could be enhanced by additional local irradiation and hormonal therapy.

Partial body irradiation is indicated in (1) metastatic chest lesions from tumors of the breast, female genital organs, testes, and connective tissue; (2) abdominal metastatic lesions from uterine and ovarian tumors, (3) generalized metastatic bone lesions, (4) disseminated lymph node involvement, and (5) pain from metastatic lesions without progressive emaciation. Contra-indications are (1) marked cachexia, (2) leukocyte count below 2,500, (3) red blood cell count below 3.5 million, and (4) thrombocyte count below 100,000. Five illustrative cases are briefly cited.

Two tables.

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RADIOISOTOPES

A Method of Measuring the Mass of the Thyroid Gland in Vivo. L. Burkinshaw. *Acta radiol.* **49**: 308-320, April 1958. (Department of Radiotherapeutics, University of Cambridge, England)

The author reports on two new methods for determining the thyroid mass with greater accuracy. He also reviews the previous published techniques including the errors associated with each method (*i.e.*, collimated gamma counter, palpation, etc.). His first method used a 1-inch crystal of sodium iodide activated with thallium, with a collimator having a cylindrical hole 7 mm. in diameter in a lead shield 6 cm. thick. The projected outlines of the thyroid gland were deduced from the isocount maps by comparing them with corresponding maps of model thyroid glands. This method was applied to 10 cases where the gland was weighed at thyroidectomy, with the surgeon estimating the percentage of the gland not removed. The results obtained with counting were not significantly better than those obtained by palpation.

The present method for estimation of thyroid mass reported by the author makes use of a new type of "slit collimator." The collimator is in the form of a narrow slit, and the operation is performed by scanning the thyroid with the long width of the slit tangent to the boundary of the gland at point of traverse. This gives a smaller penumbra in the direction of motion and exposes the source more rapidly to the crystal than a collimator with a cylindrical hole. The apparatus is mounted on a stand with an attached spring-loaded pencil to record counter position.

A preliminary scan is made with the 7-mm. diameter cylindrical collimator at about 20 per cent maximum count to act as a guide. The gland is then scanned with the slit collimator in a position horizontal to lobe length, and in a vertical position to determine gland width. The thyroid is then scanned horizontally in the two 45° projections at each boundary. The count rate rises sharply at each boundary and the counter position is recorded. The correction for the effective slit width is quite small.

The data obtained from 13 patients demonstrates the method to measure thyroid mass in diffuse toxic goiter with reasonable accuracy. These goiters retain most closely the general shape of the normal thyroid, whereas others frequently show anomalies such as enlarged isth-

mus or lobes. Equations are derived and shown to fit a straight line more closely (least-squares method) when applied to diffuse toxic goiter, as has already been stated. This method is restricted to diffuse toxic goiter. Another restriction is the time required to make measurements, which is usually thirty to forty-five minutes. The author states that the process can be shortened, without loss of accuracy, by measuring only the anterior projected width and the overall height of the gland and making the necessary calculation with the aid of equations given in the paper.

About 0.5 μ c. of I^{131} per gram of thyroid tissue is required for the measurement. When patients had been undergoing preoperative medication a large dose of I^{131} was required in order to achieve this concentration (up to 1 mc. per dose).

Two diagrams; 5 tables.

JAMES F. MARTIN, M.D.
Bowman Gray School of Medicine

Hyperthyroidism: Diagnosis by Failure of Triiodothyronine to Suppress Uptake of Iodine. Leo Smollar. *California Med.* **88**: 288-290, April 1958. (2454 Third Ave., San Diego 1, Calif.)

Of 518 men and women tested for thyroid disorders, 96 (18.5 per cent) were found to have an abnormally high uptake of I^{131} . Of these, 60 were given a second I^{131} uptake test after administration of 75 μ c. of Liothyronine (*L*-triiodothyronine) daily for seven or eight days. Before the second test each patient was carefully examined for signs of symptomatic improvement and for possible side-effects of medication. On the second test, 51 patients showed decided decrease in uptake (less than 30 per cent of the original level). That they were not hyperthyroid was confirmed by further laboratory studies and the clinical course. In 4, the uptake at the second test was between 48 and 70 per cent of the original level. These were classified as "doubtful," but the later clinical course proved them all to be euthyroid. The remaining 5 patients showed either an increase in uptake or suppression of less than 30 per cent and were therefore considered hyperthyroid. Subsequent observations, together with the response to therapy, confirmed this diagnosis.

This test would also bring to light any cases of hypothyroidism masked by high intake of I^{131} , for the drug

relieves the symptoms while suppressing the high I^{131} uptake. Euthyroid persons rarely feel any effect when given L-triiodothyronine.

The repeat I^{131} uptake test was seen to be considerably more accurate than the single test; the only disadvantage being that it adds to the diagnostic time.

Three tables.

"Thyrogenic" Infantilism Displaying an Unusual Pattern of Thyroid Function. Herman Zondek, Alex Kaatz, Hannah E. Leszynsky, Emanuel Margoliash, and Joseph A. Stein. *Brit. M. J.* 1: 546-549, March 8, 1958. (H. Z., Department of Internal Medicine, Bickur Cholim Hospital, Jerusalem, Israel)

Zondek in 1923 described a form of infantilism characterized solely by a retardation of growth and of sexual maturation which responded promptly to thyroid therapy, although none of the usual signs of thyroid insufficiency was present. A similar case is reported in the present paper, in an 18-year-old boy with the development of a 9-year-old. No thyroid enlargement was noted. There was neither body nor facial hair and the voice had a high pitch. The genitals were underdeveloped. The protein-bound iodine was 8.9 gamma per cent and 10.6 gamma per cent on two occasions. Basal metabolism determinations were +10 and +14 per cent. Laboratory studies showed no primary testicular insufficiency. Bone age corresponded to that of a child of nine, and skull films were normal.

The first radioiodine uptake study gave a hyperthyroid pattern, the second one was at the lower limits of the hyperthyroid range, and a third test showed a normal uptake.

Triiodothyronine (T_3) was given during fifty-seven days in daily doses of 60 micrograms. There was marked response, reflected in an awakened libido, sexual development, deepening of the voice, increase in height, and an increase in bone age. Basal metabolism studies initially rose to +51 per cent, stabilizing later at 17 per cent. Radioiodine tests after cessation of treatment were euthyroid.

The authors state that not all cases of sexual and somatic developmental arrest represent "thyrogenic" infantilism. The positive response to thyroid therapy is the decisive factor in diagnosis.

Three photographs; 1 table.

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Bowman Gray School of Medicine

I^{131} Metabolism in Thyroid Slices of Patients with Various Thyroidal Disorders. Otto P. Schumacher, F. Raymond Keating, Jr., and A. Albert. *J. Clin. Endocrinol.* 18: 354-366, April 1958. (Mayo Clinic, Rochester, Minn.)

Slices of thyroid tissue, obtained at operation from euthyroid patients and from patients with Graves' disease, adenoma, carcinoma, and several types of thyroiditis were studied in a gravity-flow system of incubation in a medium of constant composition containing I^{131} . The metabolism of I^{131} was expressed in terms of the clearance of I^{131} by the slice, tissue-medium T/M gradients, ability to bind iodine in organic form, and ability to discharge accumulated radioiodine in response to thiocyanate both in the unblocked state and after blocking with methimazole.

Slices of normal thyroid tissue had similar clearance values (0.03 ml./min./gm.) and T/M ratios (3 to 4)

whether organic binding was permitted or abolished. Only half of the accumulated I^{131} was protein-bound when binding was allowed, and the remaining I^{131} was dischargeable by thiocyanate. When Lugol's solution had been administered preoperatively, the above values were reduced to 50 and 75 per cent. The clearance by slices of exophthalmic goiters was tenfold, and the T/M ratios sixfold greater than those of normal tissue. The protein binding was one-third that of normal tissue. Thiocyanate induced marked discharge of I^{131} from either the blocked or the unblocked slice. The suppression due to preoperative administration of Lugol's solution was proportionally the same as noted for normal slices, but the suppressed exophthalmic-goiter tissue still metabolized I^{131} in amounts five to eight times greater than did the suppressed normal tissue.

Adenomatous tissue generally metabolized I^{131} in the same manner as normal thyroid tissue. However, in 5 cases, thiocyanate did not discharge I^{131} from the unblocked slice, and in 3 cases thiocyanate was ineffective in both the blocked and the unblocked slice. Three of the 4 thyroid carcinomas metabolized I^{131} in the same manner as normal tissue; in the fourth, however, the accumulation of I^{131} followed the pattern observed in Graves' disease, though less intense. Thiocyanate did not discharge I^{131} from slices of the first 3 carcinomas, but did so readily from the fourth or "hyperfunctioning" tissue. Slices from cases of Hashimoto's thyroiditis were "hyperfunctional" with respect to I^{131} metabolism, but less so than slices from cases of Graves' disease. Thiocyanate induced substantial losses of I^{131} from either blocked or unblocked tissue. Tissue from 2 cases of granulomatous thyroiditis showed values for I^{131} metabolism like those of normal tissue, except for the extremely low content of protein-bound I^{131} .

Five figures; 6 tables. AUTHORS' ABSTRACT

Treatment of Polycythemia Vera with Radioactive Phosphorus. Irving I. Cowan. *Wisconsin M. J.* 56: 501-505, December 1957. (Department of Isotopes, Marquette University School of Medicine, Milwaukee, Wis.)

Since 1948, radioactive phosphorus has been used in the treatment of polycythemia vera in the Isotope Department of Marquette Medical School. The author discusses the results in 38 patients so treated in an eight-year period, all on an out-patient basis. In administering the therapeutic doses, all the necessary precautions in protecting the personnel in the department from undue exposure to radiation were taken. Phosphorus was given intravenously so that only a small percentage was lost or excreted in the urine or stool. No extra precautions were taken in disposing of the excreta.

The patients ranged in age from thirty to over eighty; 13 were male. It is reported that 34 were successfully treated, but in 6 of these hematologic complications developed; there were 4 failures, 1 with hematologic complications. Eight patients were known to have died; 4 from leukemia; 2 from coronary heart disease; 1 from multiple emboli; 1 from pulmonary cancer. Four were lost to follow-up.

Radioactive phosphorus did not produce radiation sickness and resulted in longer and more complete remissions than other forms of treatment. A late complication of the disease may be leukemia, which

also occurs in patients not treated with the isotope. The etiologic relationship between P^{32} therapy and leukemia is not established but remains a possibility. It is believed that polycythemia vera in any patient who does not succumb to cardiovascular accident or disease or to some unrelated intercurrent illness will terminate in leukemia.

One chart; 5 tables.

Colloidal Radiogold in Malignant Effusions and Early Ovarian Carcinoma. T. Fichardt, E. L. Jacobs, and D. J. Savage. *South African M. J.* 32: 5-12, Jan. 4, 1958. (Department of Radiotherapy, Pretoria General Hospital and University, Pretoria, Union of South Africa)

In reviewing the use of colloidal radiogold in malignant effusions and early ovarian cancer, the authors point out that its administration is quite simple and safe from the point of view of the patient, but carries a heavy hazard for the nursing and medical staffs if strict precautions are not taken. In injecting the gold they favor the shielded-syringe method described by Lewis (*J. Fac. Radiologists* 7: 17, 1955. *Abst. in Radiology* 66: 804, 1956) and recommend that a portable half-moon lead shield be used by the nurses in attendance.

A report is made on 47 patients treated by the injection of colloidal radiogold. Of 38 with advanced malignant disease with recurrent effusion, 8 (21 per cent) died within two months after administration of 50 to 100 mc intrapleurally or 150 to 250 mc intraperitoneally. Some of those who died, however, were fluid-free. The isotope produced complete inhibition of fluid formation in 16 cases (42 per cent) for an average period of seven and a half months (in one case for thirty-one months) before death. Ten patients (26 per cent), all of whom required frequent tapping before radiogold therapy, had recurrent effusions necessitating a second course of therapy four to six weeks after the first course. After the first injection fluid formation was reduced but not completely stopped, and after the second injection it usually ceased. These patients lived, on an average, about four months after the first injection. Four (11 per cent) were alive at the time of this report: 1 for eight months, 2 for four months, and 1 for three months. No unjustifiable ill effects followed the colloidal radiogold therapy in this group and 79 per cent of the patients derived great benefit.

In 6 cases of early ovarian cancer, 150 to 250 mc of colloidal radiogold was employed following radical surgery and in the absence of any known malignant spread. Each patient received one dose only. On follow-up during the month of July 1957, the results were as follows:

Case Number	Radiogold Given	Dose (mc)	Alive and Symptom-Free in Months After Therapy
1	12/9/53	150	43
2	9/10/54	250	34
3	8/24/55	200	23
4	10/6/55	150	21
5	2/29/56	250	17
6	1/26/57	200	6

At present, all are in excellent health with no signs of any recurrence or other complications.

Three miscellaneous cases are reported:

(1) In a case of ovarian cancer with peritoneal spread in a 45-year-old woman, hysterectomy and bilateral salpingo-oophorectomy (9/15/54) were followed by roentgen therapy of 3,600 r administered in a four-week period beginning Oct. 12, and an injection of 150 mc of colloidal radiogold into the peritoneal cavity on Nov. 16. Thirty-three months later the patient was alive and symptom-free.

(2) Peritoneal spread of a uterine cancer was discovered in the course of a hernia operation two years after a hysterectomy in a 55-year-old woman. Colloidal radiogold was administered intraperitoneally, and twenty-four months afterward, the patient was alive and symptom-free.

(3) Two months after a hemicolectomy for carcinoma of the cecum which had penetrated to the peritoneal covering, colloidal radiogold was administered intraperitoneally to a 55-year-old man. He made an uneventful recovery, but returned twenty-one months later with intestinal obstruction due to adhesions. There was no evidence of metastases at the time of the second operation. The patient was alive and symptom-free twenty-three months after the radiogold therapy.

Four roentgenograms; 1 gammagram; 3 photographs; 4 tables.

Absorption of Cobalt⁶⁰-Labeled Vitamin B₁₂ After Subtotal Gastrectomy. Fritz Loewenstein. *Blood* 13: 339-347, April 1958. (Radioisotope and Medical Services, VA Hospital, Boston, Mass.)

Absorption of cobalt⁶⁰-labeled vitamin B₁₂ was measured after subtotal gastrectomy. In 5 patients who underwent a conventional (distal) subtotal gastrectomy because of peptic ulcer, the absorption of vitamin B₁₂ did not change significantly as a result of the removal of most of the stomach. In 1 patient who had had a two-thirds gastrectomy five years previously, a trans-abdominal vagotomy produced no change in ability to absorb vitamin B₁₂.

Twenty-four additional patients were studied at variable periods after a distal subtotal gastrectomy. In 2 with very extensive subtotal resections which left behind only a few centimeters of the cardiac portion of the stomach, absorption of vitamin B₁₂ was subnormal but not in the range found in pernicious anemia. Nineteen of the remaining patients absorbed vitamin B₁₂ normally. In the other 3, absorption was in or near the range of values obtained in pernicious anemia and was corrected to or near the normal range when gastric juice was given with the test dose.

Three patients were studied following removal of only the superior portion of the stomach plus several centimeters of the lower esophagus. In each, the result of the vitamin B₁₂ absorption test fell within the normal range.

All 3 patients with low vitamin B₁₂ absorption after a conventional gastrectomy were tested more than six years postoperatively, whereas most of the patients who had normal absorption had undergone gastrectomy within six years (on an average three years). This finding suggests that the causes of intrinsic factor deficiency after subtotal gastrectomy require years to produce their effect. Macrocytic anemia was not observed in the cases where absorption was low, perhaps because the absorptive defect had not existed long enough to produce a deficiency state.

Three patients who had the upper (proximal) portion

of the stomach removed were able to absorb vitamin B₁₂. Since both the distal fourth and proximal fourth of the stomach can produce enough intrinsic factor to maintain normal B₁₂ absorption, it appears that the secretion of intrinsic factor takes place in a wide area of the stomach. Four tables.

Attempt at Tumor Localization Using Cu⁶⁴-Labeled Copper Porphyrins. Robert Bases, S. Steven Brodie, and Sidney Rubinfeld. *Cancer* 11: 259-263, March-April 1958. (R. B., National Institutes of Health, Bethesda, Md.)

It has been recognized for some time that porphyrins concentrate in mouse tumors, while later work indicates that concentration occurs not only in neoplastic but also in inflammatory and lymphatic tissues of both men and animals.

The authors administered Cu⁶⁴-labeled porphyrins to 23 patients with a variety of cancers in an attempt to localize their neoplasms. Cu⁶⁴ has a half-life of 12.8 hours, and emits a 1.34 MEV gamma ray and a 0.55 MEV electron and a 0.67 MEV positron.

Preferential localization in the tumors did not occur. The porphyrins were rapidly taken up by the liver and spleen and were excreted mainly in the feces. Possible reasons for failure of the copper porphyrins to localize in tumors when free porphyrins have been repeatedly noted to do so are briefly discussed.

Two tables. CHARLES M. GREENVALD, M.D.
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The Metabolic Fate of C¹⁴-Progesterone in Human Subjects. Avery A. Sandberg and W. Roy Slaunwhite, Jr. *J. Clin. Endocrinol.* 18: 253-265, March 1958. (Roswell Park Memorial Institute, Buffalo, N.Y.)

C¹⁴-progesterone was injected intravenously into 9 human subjects, 4 of whom had bile fistulas. In each instance, slightly over 50 per cent of the radioactivity was excreted in the urine. At least 40 per cent of the urinary radioactivity was in the form of glucuronides and over 60 per cent of the radioactive metabolites was extractable from the urine following all hydrolytic procedures. Nearly 30 per cent of the radioactivity was excreted in the bile, mostly as conjugates and metabolites not extractable following the various hydrolytic procedures. The amount of radioactivity excreted in the stools averaged 13 per cent and 3 per cent in the nonfistula and fistula subjects, respectively. The recovery of the total radioactivity in the urines and stools of the nonfistula subjects averaged 67 per cent, in contrast to the 82 per cent recovered in the urine, bile, and feces of the bile-fistula subjects. These data are most consistent with substantial biliary excretion of metabolites of progesterone, consequent reabsorption of a major part of the metabolites, and excretion of the remainder in the stools. Seemingly, the reabsorbed biliary metabolites were not excreted in the urine.

The unconjugated steroids, following the intravenous administration of C¹⁴-progesterone, were cleared from the plasma at two rates, with half-lives of twenty and ninety minutes, respectively. The levels of glucuronide in the plasma were eight times as high as those of the unconjugated steroids within fifteen minutes following the injection of C¹⁴-progesterone, indicating rapid metabolism of the steroid. The radioactivity

levels in the sulfate fraction of the plasma were much lower than those in the glucuronide fraction.

[Throughout this paper the word "unconjugated" refers to steroid metabolites which are extractable with ether or chloroform before performance of any hydrolytic procedures; the "glucuronides," to steroid metabolites which become extractable with ether or chloroform following β -glucuronidase hydrolysis; and the "sulfates," to steroid metabolites which are recovered by continuous extraction with ether for forty-eight hours at pH 1.]

Five figures; 4 tables.

The Plasma Insulin-I¹³¹ in Diabetic Patients. Robert E. Bolinger and Harold J. Grady. *Ann. Int. Med.* 48: 753-764, April 1958. (University of Kansas Medical Center, Kansas City 12, Kans.)

Twenty diabetic patients were divided into four groups: a normal group, a group of obese diabetics, a group of adult diabetics dependent upon insulin but without a history of acidosis, and a group of diabetics with onset during the growth period, and with a history of acidosis. I¹³¹-labeled insulin was administered and the disappearance curve from the plasma was studied. There is an initial rapid disappearance completed in a few minutes and a slower second phase following a logarithmic relationship. This second slow phase was particularly studied, and the parameters of these disappearance curves were not characteristic of any group. The initial concentration of insulin for the obese group was significantly lower than that for the normal group, however.

Since the size of the unlabeled insulin pool is difficult to assess accurately, correlation of data obtained from the use of labeled insulin with clinical data is difficult.

Three figures; 3 tables.

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The Uptake of Radioactive Calcium by Sea Urchin Eggs. I. Entrance of Ca⁴⁵ into Unfertilized Egg Cytoplasm. Sidney C. Hsiao and Howard Boroughs. *Biol. Bull.* 114: 196-204, April 1958. (Department of Zoology, University of Hawaii, Honolulu, T.H.)

The entrance of radiocalcium into unfertilized eggs of *Tripleneustes gratilla* (Linnaeus), a large, common species of sea urchin in Hawaiian waters, was investigated. By direct measurement of the radioactivity of intact eggs and of eggs without jelly coats, it was found that, although both types of eggs took up Ca⁴⁵, eggs without jelly coats took up much more than intact eggs.

After all the eggs had been made radioactive by incubation in sea water containing radiocalcium, it was found that jelly-free eggs retained eleven times as much Ca⁴⁵ as intact eggs when washed with a commercial wetting agent "Sterox SK" and six times as much when washed with a dilute solution of "Tide." The consistently greater amount of Ca⁴⁵ taken up by eggs without jelly coats indicates that not only is the jelly coat unnecessary for the uptake of radiocalcium, but it acts as a hindrance to the entrance of these ions into the egg cytoplasm.

If intact eggs were incubated in sea water containing radiocalcium, autoradiographs showed the presence of Ca⁴⁵ in the jelly coat. Autoradiographs of sections of intact eggs and of eggs without jelly coats showed Ca⁴⁵ to be inside the egg cytoplasm and firmly attached to the organic compounds of the egg.

No significant difference in total calcium was found by chemical analysis of groups of eggs incubated for various periods of time in Ca^{45} -containing sea water, i.e., made to take up varying amounts of radiocalcium. In none of the groups thus incubated was the content

of total calcium significantly different from that of ordinary unfertilized eggs. The conclusion is reached that Ca^{45} enters the egg cytoplasm by exchange with Ca^{40} of the eggs.

Six photomicrographs; 3 graphs; 1 table.

RADIATION EFFECTS

Radiation Hazards of Intravenous Pyelography. Irving Van Woert, Jr., Paul I. Kearney, Ilhan Kilicoglu, and John F. Roach. *J.A.M.A.* 166: 1826-1828, April 12, 1958. (Albany Medical College, Albany, New York)

Because of the possibility that radiation to the gonads may have undesirable effects manifested in future generations, diagnostic intravenous pyelography has been selected for study in the following respects: (1) indications for the procedure, (2) determination of gonadal dose, (3) methods to protect the gonads.

Records of 200 consecutive pyelographic studies were reviewed and 75 per cent of these were found to be clinically justified on the following indications: (1) typical renal colic, (2) mass in kidney area, (3) hematuria, (4) carcinoma of cervix, (5) hypertension, (6) trauma, (7) recurrent ureteral disease, (8) neurogenic bladder, (9) adrenal tumor, (10) postoperative urinary tract recurrent symptoms.

The dose to the ovaries was estimated at 0.2 r to 0.5 r, and to the testes from 0.1 r to 4 r.

The amount of radiation to the gonadal regions can be appreciably decreased without interfering with the diagnostic accuracy of the examination. A piece of lead or lead rubber is used to cover the testes in the male patient and the same is employed to cover the lower half of the abdomen in the female patient.

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Gonadal Dose from Mass Miniature Chest X-rays. H. E. Johns and J. C. Wilson. *Canad. M. A. J.* 78: 571-575, April 15, 1958. (Physics Division, Ontario Cancer Institute, Toronto, Canada)

A committee of the medical section of the Ontario Tuberculosis Association in cooperation with the Department of Health initiated a study designed to measure the gonadal dose actually received in the mass chest radiography program in that Province.

Measurements were carried out on a paraffin wax phantom in the shape of a human torso. A 5-cm. hole was drilled from the anterior surface of the phantom in such a way that the ion chamber could be centered at a point 3.5 cm. anterior to the sacroiliac joint at the level of the pelvic brim, a point considered to be the average position of the ovaries. For measurements on the male, the same phantom was used but the chamber (a Baldwin Farmer protection electrometer No. 122) was fastened between the thighs with adhesive tape. The mean exposure time with the various units used in the mass roentgenologic survey was determined by observing the total time of exposure for a number of subjects.

The authors estimated the mean gonadal dose per examination under present circumstances to be 0.7 mr and 12 mr, respectively, for males and females. Their experiments lead to the conclusion that the dose may be reduced by replacing all circular cones with rectangular

cones and inserts; making sure the beam does not extend below the fluoroscopic screen; positioning the subject with the iliac crest as far below the screen edge as possible (the practice of positioning the subject with his chin on the top of the screen should be stopped); increasing the speed of the camera screen and film, and avoiding overexposure and underdevelopment; if anything, films should be slightly underexposed and overdeveloped.

Since these experiments were carried out, all miniature film units in Ontario are being equipped with proper cones and inserts and the units are being carefully aligned to insure that the beam does not extend below the fluoroscopic screen. With these precautions, the gonadal dose from mass chest surveys may be reduced to 0.26 mr or 0.25 per cent of background radiation, where it is probably not a radiological problem. With the use of faster films, which are becoming available, this dose can probably be reduced by a further factor of 2.

Three figures; 5 tables.

Presumed Radiation Carcinoma of the Tongue Base and Carcinoma of the Thyroid: Resection, with Tube Pedicle Repair; Report of a Case. William R. Nelson and A. William Mayer, Jr. *Arch. Surg.* 76: 611-616, April 1958. (2306 Monument Ave., Richmond, Va.)

At the age of 22 years a white male underwent thyroidectomy, followed by re-excision of a thyroid mass four years later for presumed carcinoma (substantiating records not available). Five years after the first operation the patient was seen with locally recurrent thyroid carcinoma with adjacent metastatic cervical nodes. Since only part of the tumor could be removed by additional surgery, radiotherapy was given, 4,200 r being delivered to the anterior neck (details of radiotherapy not available). Further localized resectional surgery was done for recurrence eighteen months later.

Nineteen years after the first operation and fourteen years after the course of radiotherapy, the patient was re-examined because of difficulty in swallowing, of six months duration. An extensive polypoid tumor was found at the base of the tongue, invading the vallecula, epiglottis, and adjacent intrinsic laryngeal structures. The skin of the neck showed advanced chronic radiation changes overlying the tongue tumor. Curative excisional surgery with bilateral neck dissection, total laryngectomy, and partial pharyngectomy was undertaken. The large operative defect was closed in stages by plastic graft procedures extending over many months. One year after excision the patient was able to swallow and no tumor was evident.

The authors believe this case qualifies as "radiation carcinoma of the tongue" following a course of radiotherapy for a carcinoma of different histology (papillary adenocarcinoma of the thyroid). A brief résumé of similar cases reported in the literature is presented in tabular form.

One roentgenogram; 2 photomicrographs; 3 photographs; 1 diagram; 1 table.

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Unnecessary Radiation Exposure from Radium.

Jan Lieben. *Pennsylvania M.J.* 61:215-217, February 1958. (Division of Industrial Hygiene, Pennsylvania Department of Health, Harrisburg, Penna.)

In general, it can be said the radiation from isotopes is fairly well controlled, mainly because of the practice of the Atomic Energy Commission limiting licenses to those with proved knowledge of the hazards involved. Radium, however, can be purchased commercially and is frequently handled with negligence. Three case reports of avoidable radiation thoughtlessly given to doctors, hospital personnel, and/or patients are given.

In accordance with the Pennsylvania Department of Health regulation, each installation or hospital should have one person with supervisory responsibility for the safe handling and operation of all radiation sources. He should be guided by a staff radiation safety committee. Standard operating procedures should be instituted for storage, preparation, and transportation of radium. Nursing procedures for the handling of patients are also necessary considerations in controlling exposure to radiation.

Important factors which can be utilized to minimize exposure to any radiation include:

Time: The less time spent in the immediate vicinity of a radiation source, the less total radiation received.

Distance: The further away from a radiation source, the less radiation received. *Shielding:* The more material and the denser the material between the radiation source and the surroundings, the less radiation received.

In addition, radium should be stored in a properly posted room in a lead safe; preparation of radium applicators or needle threading should be entrusted only to persons familiar with the principles of radiation and its dangers, and accustomed to the use of approved methods of protection; radium should not be removed from the storage safe any earlier than is absolutely necessary, should be transported only in the lead-lined carrier, and should not be left in the operating room; the patient should be housed in a separate room or, if that is not possible, placed in a bed at least 10 feet from any other patient; special nurses when not actually waiting on the patient should be at least 10 feet away, preferably out of the room; the amount of visiting time should be determined by the radiation safety officer; the radiation storage area, patients under treatment, and the operating room should be monitored from time to time; because on rare occasions radium salts and its daughter products may escape from the sealed radium needle or container and give rise to contamination with alpha particles, wipe tests should be undertaken by specially trained personnel at regular intervals.

Ionizing Radiation and a Sense of Proportion.

George Tievsky. *J.A.M.A.* 166:1667-1672, April 5, 1958. (1739 Eye St., Washington 6, D. C.)

This paper is addressed to the nonradiologist practitioner with little or no background in radiation biology or physics. It is pointed out that no one can give a magic figure in reference to patient radiation dosage and say that this patient has reached the limit of expo-

sure and that another patient may have more. However, on our present knowledge, broad general principles regarding radiation protection can be developed.

Although the public has only recently become aware of the danger of ionizing radiation, it has been under scrutiny of well organized bodies of scientists for thirty years. Radiation effects on man are discussed, both the genetic effects of long-range concern to the human race and the somatic effects of immediate concern to the individual.

A sense of proportion is necessary in regard to the legitimate use of radiation, with evaluation of the degree of hazard versus the net gain to the patient.

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The Rational Use of X-Ray in Medicine and Dentistry with Particular Regard to Protective Measures.

A. Bradley Soule, Jr., Hans Heilbronn, and Ralph Bannister. *J. Maine M. A.* 49:125-134, April 1958. (Mary Fletcher Hospital, Burlington, Vt.)

This is a common sense report inspired by the public panic following indiscriminate publicity regarding the hazards of ionizing radiation. A summary of the 1956 report of the National Academy of Sciences for the National Research Council is included. Biological hazards other than genetic are recognized with mention of leukemia and carcinoma occurring in patients who have been exposed to ionizing radiation.

The authors, as a routine, use lead shielding to decrease the total-body and gonadal radiation and a table is presented with the average gonadal dosage for various examinations.

As a guide for making x-ray examinations, it is suggested: (1) that such studies be made by qualified personnel only; (2) that Bureau of Standards *Handbook 60* "be used as a bible in checking all conditions in the radiology department;" (3) that the field of radiation be limited; (4) that fluoroscopy should be performed only by trained physicians with proper equipment; (5) that technicians and attending personnel observe protective measures; (6) that a monitoring system be used; (7) that routine preemployment physical and progress examinations should be carried out.

Roentgenography during pregnancy should be limited to the least number of exposures necessary, done only by qualified technicians, with lead rubber to protect the fetus. In urologic examinations, lead covering the lower pelvis will protect the gonads from excess radiation. The urologist may himself be protected by a lead shield extending from the tube to the table, for retrograde injections. Attending personnel may and should be protected by distance and the use of a "shovel" or other "gadget" instead of the hand to hold the film in place.

Survey radiographs of the chest with conventional film with a protective screen across the abdomen provide 30 times less radiation than a photofluorogram.

Fluoroscopic shoe fitting devices are mentioned only to be condemned.

A double hazard exists in dental offices: a direct hazard to the patient and an occupational hazard for the personnel. A full mouth examination may result in as much as 113 to 315 rems to the face and neck, and attendants may receive as much as 1 rem/hour. Lead diaphragms, 2 mm. added aluminum filter, high kilovoltage technic, and added lead bibs can reduce the radiation to a safe level.

Radiation therapy over a large area for benign conditions should be used sparingly if at all. Malignant lesions must be treated and are not considered in this paper. Isotopes should be used judiciously. Diagnostic ^{131}I tests are well within safe limits, but therapeutic doses for hyperthyroidism will deliver 8 to 16 rems to the gonads.

One roentgenogram; 8 photographs; 2 tables.

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Staff Protection in an Australian Diagnostic X-Ray Department. Morris Owen. *M. J. Australia* 1: 35-36, Jan. 11, 1958. (Royal Newcastle Hospital, Newcastle, Australia)

A study is reported of film-badge readings in a diagnostic x-ray department in an Australian hospital. The average number of examinations per month was 3,300. Monitoring films were carried by all members of the staff working in areas regarded as subject to abnormal radiation: radiologists, radiographers, trainee-radiographers, and those performing general duties. The film badges were worn on the chest or at waist level during working hours throughout the year and the films were renewed each month.

During the year July 1956 to June 1957, the doses recorded ranged from "negligible" to 50 mr. The recorded radiation was "negligible" for some personnel on all occasions and for all personnel for several months.

Protection features included the use of distance, lead (or equivalent) screening, and the avoidance of direct radiation. Personnel were not permitted to hold patients or, with the exception of mobile x-ray work, to be away from protection screens during radiography. During fluoroscopic examinations, the radiologist and students remained behind the protection afforded by the screen-spot-film device and its lead apron, and other staff members behind lead-screen protection. The radiologist wears a lead rubber apron and his examining hand is gloved in lead rubber. All x-ray tubes have a minimum of 2 mm. added aluminum filtration.

While it is obvious that personnel receive some radiation, frequently so little as not to be measurable with film badges, the record is regarded as satisfactory by present-day standards.

Three tables.

Electron-Irradiated and Freeze-Dried Arterial Homografts: Experiences at the St. Louis City Hospital Artery Bank. Falls B. Hershey, John G. Trump, H. James Solomon, Kenneth A. Wright, and Samuel Joseph. *Ann. Surg.* 147: 562-570, April 1958. (VA Hospital, St. Louis 6, Mo.)

Artery bank specimens taken more than six hours after death or contaminated by infection or malignant disease are believed to be most satisfactorily sterilized by the "frozen-irradiated" method. The technique of preparation of these specimens is as follows: The specimen is quickly frozen by immersion in a slush of dry ice and hexane (-78°C.) and then placed in a length of polythene tubing the ends of which are heat-sealed. This tube is sealed in a second, larger tube containing an identifying label and glass bead to indicate ionization sterilization by change of color. While maintained in the frozen state, the graft is irradiated to a peak of two million rads (minimum of 1.2 million rads) by a Van de Graaff type of accelerator. The irradiated specimens are stored at dry ice temperature.

One hundred and fifty-four frozen irradiated grafts have been utilized and there have been no failures due to infection or disruption attributable to failure of sterilization process.

For normal arterial specimens taken in less than six hours after death, a freeze-drying method is utilized.

Three figures; 1 table.

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Transplantation of Homologous Erythropoietic Elements in Rats After Sublethal Doses of X Radiation. T. L. Odell, Jr., and B. C. Caldwell. *J. Nat. Cancer Inst.* 20: 851-858, April 1958. (Biology Division, Oak Ridge National Laboratory, Oak Ridge, Tenn.)

The authors studied the influence of the dose of radiation on the success of marrow homotransplantation in the rat system as carried out in previous experiments. (See *Proc. Soc. Exper. Biol. & Med.* 90: 512, 1955.)

Long lasting and extensive transplants of donor marrow were observed in about a fourth of the rats receiving 300 or 500 r of x-rays (LD 50/30 days, 725 r). There were no permanent transplants in rats that received 225 r or less, but in some animals donor-type red cells were present in small numbers for as long as fifty-six days. Some of these red cells may have been injected with the bone marrow. It is also suggested that the lower doses of radiation may have briefly inhibited the immune mechanism in some animals sufficiently to allow the foreign tissue to start growing, but when the recipient's reactivity recovered, the graft regressed.

Present information emphasizes the importance of genetic similarity between donor and recipient, possibly the function of common inheritance of certain histocompatibility genes (which may or may not also be determinants of blood type).

Two graphs; 1 table.

Peripheral Blood of the X-Irradiated Rhesus Monkey. A. J. Riopelle, H. A. Ades, and F. E. Morgan, Jr. *Radiation Res.* 7: 581-590, December 1957. (A. J. R., Army Medical Research Laboratory, Fort Knox, Ky.)

Three groups of 4 rhesus monkeys each were irradiated with 350 r, 1,000 r, or 2,000 r, by means of a Westinghouse 200-kv therapy x-ray machine. The latter dosages were fractionated into ten exposures delivered at two-week intervals.

The total leukocyte response reflected primarily the behavior of lymphocytes and neutrophils, tending to follow the lymphocyte curve more closely because of the greater number of cells of this type in the blood of the monkey. The responses of the two systems was, however, very similar. After a single exposure to 350 r there was an immediate depression in the leukocyte values and then rapid recovery. After repeated doses the depression persisted throughout the irradiation program, after which recovery was very slow. During the period when the white blood count was depressed, day-to-day variability was reduced, presumably reflecting the failure to respond to the metabolic needs. Monocyte and basophil counts returned to normal values much more slowly after the initial depression, with more rapid elevations five or more months after the first exposure. All white blood counts were subnormal one and a half years after the initial irradiation. The hemoglobin, although apparently dropping over a pro-

longed period of time, was within normal range after one and a half years.

The blood picture of an atypical animal is presented. Seven graphs; 4 tables.

Gamma-Radiation and Longevity of the Flour Beetle. J. M. Cork. *Radiation Res.* 7: 551-557, December 1957. (Department of Physics, University of Michigan, Ann Arbor, Mich.)

It is a well known fact that any living organism may be destroyed by ionizing radiation, the amount necessary to produce death being dependent on the kind employed and the nature of the specimen. The ability of radiation to produce mutations has also been widely explored. Perhaps too little attention has been given, however, to the possibility of actually extending the normal life span by this same radiation. The author carried out such an investigation on the flour beetle. Beetles, in a food culture at the bottom of a large test tube, were placed in an irradiation well, consisting of a hollow spherical shell surrounded by a solution containing 2 curies of radioactive cesium 137. Either large single doses of varying amounts or small daily doses were administered throughout the complete life of the specimens. The experiment involved an enormous number of observations over a period of two years. Some of the controls as well as some of the irradiated beetles survived. From the averages, however, there appeared to be a definite "longevity" effect, of about 16 per cent, in favor of the irradiated specimens, and it is concluded that the life span of a given number of flour beetles may be extended by several per cent by gamma irradiation, either a single exposure of proper dosage of about 3,000 r or chronic daily dosages of about 100 r. It is hoped that the results of this investigation will encourage other studies of a similar or supplementary nature. They should not be construed as license for x-ray practitioners to become less critical of recognized safety factors in dealing with the human organism.

Three illustrations; 1 table.

The Effect of X-rays, Irradiated Sea Water, and Oxidizing Agents on the Rate of Attachment of Bugula Larvae. William F. Lynch. *Biol. Bull.* 114: 215-225, April 1958. (St. Ambrose College, Davenport, Iowa.)

Irradiating larvae of either *B. flabellata* (18,333 r) or *B. turrita* (15,733 r) within thirty minutes after the organisms began to emerge from the parental colonies induced more rapid setting than occurred in the controls ($P = 0.005$ and 0.001 , respectively). Irradiated sea water had a similar but slightly less pronounced effect. In these experiments the subsequent development of larvae of *B. turrita* into zooids was drastically impeded. Slow growth, usually without differentiation, was observed.

Sea water solutions of H_2O_2 ($7 \times 10^{-4} M$), of 2,3,5-triphenyltetrazolium chloride ($1 \times 10^{-5} M$), and of sodium 2,6-dichlorobenzenoneindophenol ($3.4 \times 10^{-8} M$) at a pH of 7.8 to 8.0 also induced more rapid setting of the experimental larvae ($P = 0.001$, 0.015, and 0.015, respectively). The subsequent development of larvae exposed to H_2O_2 and to 2,3,5-triphenyltetrazolium chloride resembled that of organisms that were either irradiated or placed in irradiated sea water. Sodium 2,6-dichlorobenzenoneindophenol was less injurious to the larvae than the other agents used. An explanation of the possible role of these agents in inducing an accelerated rate of setting is presented.

The action of x-rays in inducing fixation of *Bugula* larvae would not be out of harmony with the working hypothesis that attachment, when artificially induced, is brought about by agents which cause coagulation. The possibilities just discussed may form a link which would connect the effect of photodynamic dyes with that of x-rays, since both agents may release H_2O_2 or organic peroxides.

[*Bugula* belongs to the Bryozoa, a class of aquatic animals which reproduce by budding and usually form permanently attached colonies, often of a branched, moss-like form.—Ed.]

Five tables.



